APPLIED HYDRAULICS

DECEMBER 1954

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

IN THIS ISSUE:

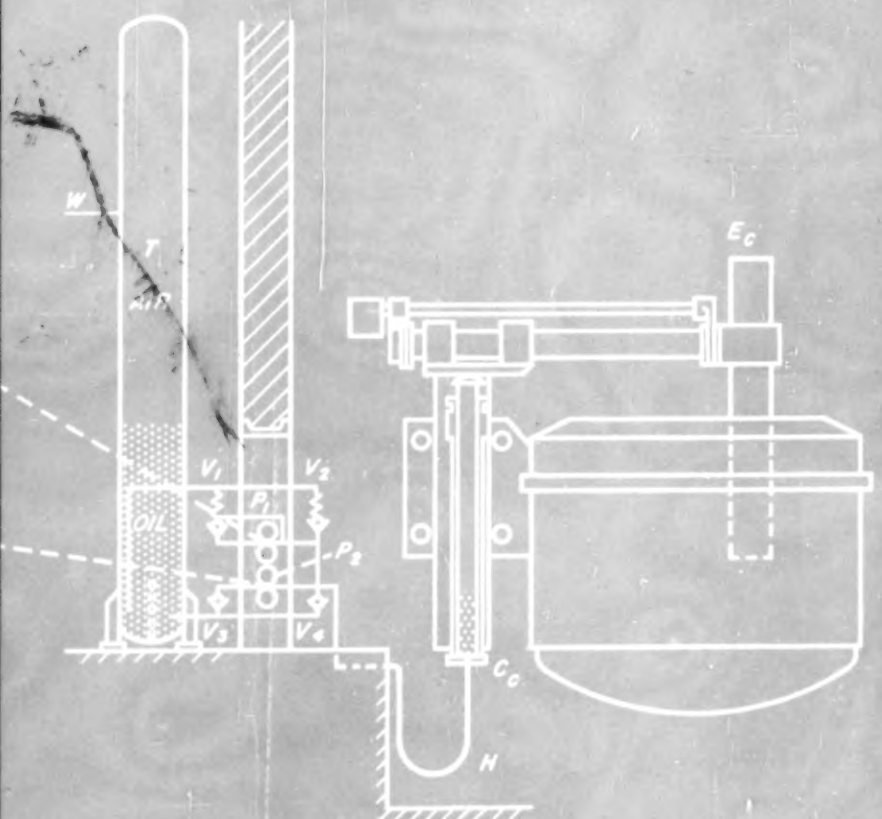
Bar Bending with Oil Power . . . page 41

Hydraulic and Electric Machine Tool Circuits . . . page 44

Low Pressure Bleeding of Aircraft Brake Systems . . . page 52

Air Lube System for Conveyor Lines . . . page 72

FRANCHISE CIRCULATION

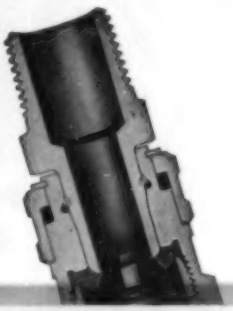


Two Pump Metering Circuit

. . . page 33

Everything You Want

in a Quick-Connective Pneumatic Coupling



HA
RING-

Compactly desig
handles far more
On any job requir
air tool—this sin
pletely interchang
to keep stock of

To connect the Se
the Socket. To dis
nected, a locking
positive lock and
Plugs are steel. S
are available in

WA
PAG

- Smaller.
- Lighter.
- Effectively handles more volume than any other coupling of equal dimensions.
- Handles any job with fittings from ¾" to ⅛", from the air line to the air tool.
- All Series 3-RL Sockets and Plugs are interchangeable—reduces stock inventory to a minimum.
- One-way shut-off—for pneumatic service applications.
- Positive locking.
- Equipped with automatic sleeve lock.

Relative size of ordinary coupling required for effective handling of same volume

Write for Descriptive Literature

THE HANSEN MANUFACTURING COMPANY

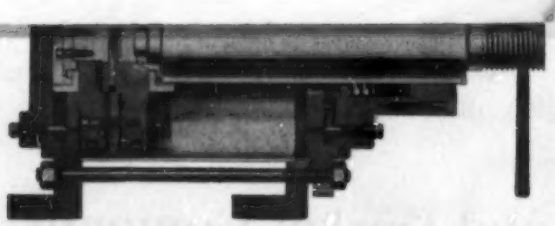
4031 WEST 150th STREET • CLEVELAND 11, OHIO

Fill in No. 43 on Reader Service Card

How your CYLINDERS can Last Longer

AVY

GES



WHEN YOU INSTALL an air cylinder you want to insure the long life and trouble-free performance for which the cylinder was designed. Cylinders of ample capacity for the job should be used . . . Operating pressure should not exceed maximum cylinder rating. Trouble is often caused by use of the improper cylinder mounting style and by the piston rod being incorrectly aligned with the load to be pushed or pulled. Where the atmosphere contains moisture or abrasive dust, piston rod protective boots are desirable. Speed control valves in the air line may be necessary, particularly in moving high inertia anti-friction loads horizontally. Standard cushions, or even "super" cushions may be needed. Filters and lubricators are desirable.

WHEN YOU INSTALL a HANNA® Air Cylinder you have the *best* assurance of long cylinder life . . . you have consistently efficient performance . . . you have minimum maintenance. Hanna Cylinders combine such important features as removable bronze check valves, piston-packing expander springs, floating bronze cushion sleeves, self-adjusting, spring-backed rod packings and two-piece threaded flange and head construction.

YOUR BEST GUARANTEE of carefree cylinder operation is your specification of Hanna Cylinders followed by correct installation. The Hanna Cylinder and Valve Line has sufficient breadth to best meet your particular power needs. Send for free copy of Bulletin showing Hanna Cylinder Power in Action.

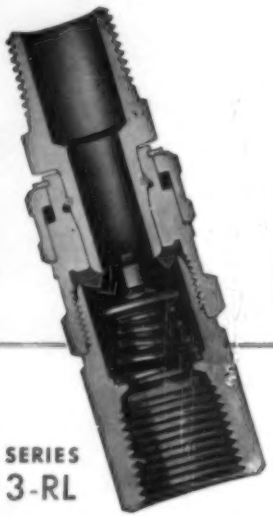
Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1741 Elston Avenue, Chicago 22, Illinois

Everything You Want

in a Quick-Connective Pneumatic Coupling



HANSEN SERIES 3-RL

RING-LOCK COUPLING

Compactly designed, the Hansen Series 3-RL Coupling *effectively* handles far more volume than any coupling of equal dimensions. On any job requiring ¼" to ⅛" connections—from the air line to the air tool—this single size Hansen Ring-Lock Coupling—with completely interchangeable Sockets and Plugs—does it all—makes it easy to keep stock of parts in balance—holds inventories to a minimum.

To connect the Series 3-RL Coupling, you merely push the Plug into the Socket. To disconnect, just turn the sleeve. When Coupling is connected, a locking ring in Socket is forced into groove in Plug, provides positive lock and insures tight fit. Sockets are brass with steel sleeves. Plugs are steel. Sockets for use with small hand-operated air tools are available in aluminum.

- Smaller.
- Lighter.
- Effectively handles more volume than any other coupling of equal dimensions.
- Handles any job with fittings from ¾" to ⅛", from the air line to the air tool.
- All Series 3-RL Sockets and Plugs are interchangeable—reduces stock inventory to a minimum.
- One-way shut-off—for pneumatic service applications.
- Positive locking.
- Equipped with automatic sleeve lock.

Relative size of ordinary coupling required for effective handling of same volume

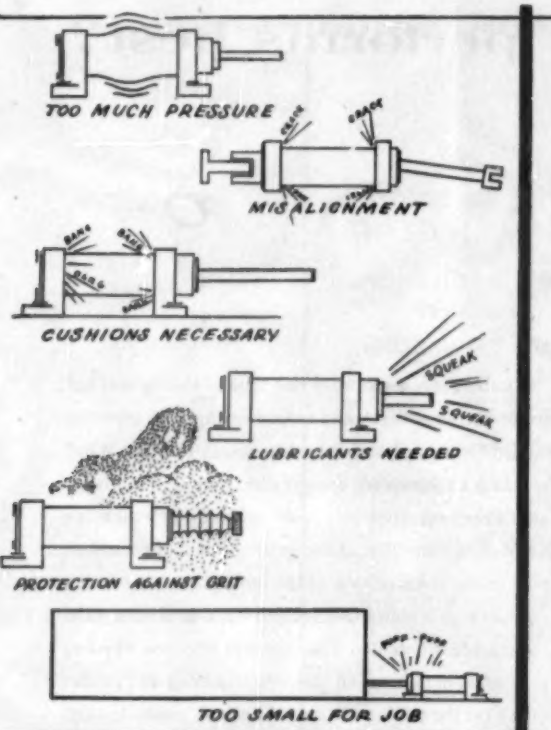
Write for Descriptive Literature

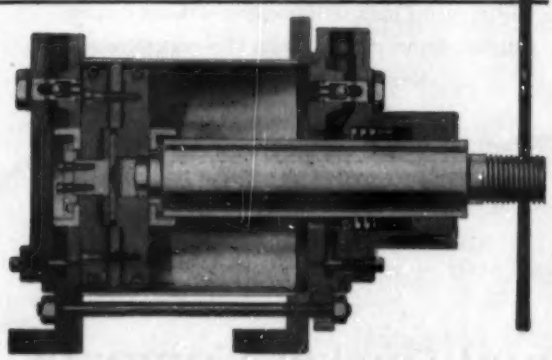
THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

Fill in No. 43 on Reader Service Card

How your CYLINDERS can Last Longer





WHEN YOU INSTALL an air cylinder you want to insure the long life and trouble-free performance for which the cylinder was designed. Cylinders of ample capacity for the job should be used . . . Operating pressure should not exceed maximum cylinder rating. Trouble is often caused by use of the improper cylinder mounting style and by the piston rod being incorrectly aligned with the load to be pushed or pulled. Where the atmosphere contains moisture or abrasive dust, piston rod protective boots are desirable. Speed control valves in the air line may be necessary, particularly in moving high inertia anti-friction loads horizontally. Standard cushions, or even "super" cushions may be needed. Filters and lubricators are desirable.

WHEN YOU INSTALL a HANNA® Air Cylinder you have the *best* assurance of long cylinder life . . . you have consistently efficient performance . . . you have minimum maintenance. Hanna Cylinders combine such important features as removable bronze check valves, piston-packing expander springs, floating bronze cushion sleeves, self-adjusting, spring-backed rod packings and two-piece threaded flange and head construction.

YOUR BEST GUARANTEE of carefree cylinder operation is your specification of Hanna Cylinders followed by correct installation. The Hanna Cylinder and Valve Line has sufficient breadth to best meet your particular power needs. Send for free copy of Bulletin showing Hanna Cylinder Power in Action.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1741 Elston Avenue, Chicago 22, Illinois

What type of O-ring performs best?

Laboratory tests prove one type of O-ring seal has greater tensile strength and longer flexing life—injection molded O-rings produced by Minnesota Rubber. Why? Ordinary O-rings are compression molded—a process that forms extrusion or "flash" resulting in weakening trimming blemishes at the parting line and variations in the cross-section of the molded part.

Minnesota Rubber O-rings and custom molded parts are made differently. The exclusive injection molding process eliminates all machine trimming and rubber flash on the sealing surfaces. Constant result: O-rings and special rubber parts with smoother surfaces, tougher structure, higher density, longer life—with tolerances closer than ± .001 inch. The cost? Lower than the industry average!

No matter how tough your O-ring problem, Minnesota Rubber will help you off the horns of your dilemma. Write today for complete details. Ask for the free catalog 9-B, "O-rings", for helpful information.

Minnesota Rubber and Gasket Company

3630 Wooddale Avenue, Minneapolis 16, Minn.

Dept. 301

Phone MOhawk 9-6781

APPLIED HYDRAULICS

VOLUME 7 NUMBER 12

DECEMBER 1954

Paul L. Reed
Editor

Paul Reinick
Associate Editor

A. W. Benkendorf
Assistant Editor

Alaric Mausser
Art Director

FEATURE ARTICLES

TWO PUMP METERING CIRCUIT 33
By C. W. Vokac

HYDRAULIC PRESS DESIGN ASSURES ACCESSIBILITY 38

SHOP-BUILT BOX FORMER SAVES $1200 A YEAR 40

COMPLICATED BAR BENDING WITH HYDRAULIC POWER 41

HYDRAULIC AND ELECTRIC CIRCUITRY FOR MACHINE TOOLS 44
By H. W. Brown and J. H. Smith

AIR POWERED LUBE SYSTEM PROTECTS CONVEYOR LINES 48
By Carl S. Abbott

AIR OPERATED DEVICES SPEED MACHINE LOADING 72

NCIH HOLDS OUTSTANDING 10TH ANNIVERSARY MEETING 76

1954 APPLIED HYDRAULICS EDITORIAL INDEX 108

AVIATION SECTION

LOW PRESSURE BLEEDING OF AIRCRAFT BRAKE SYSTEMS 52
By Robert Spurr

REPORT OF SAE AIRCRAFT MEETINGS 56

DEPARTMENTS

FLUID POWER LINES 6

USEFUL LITERATURE 10

BRIEFS 14

NEW PRODUCTS 18

LETTERS TO THE EDITOR 22

POST SCRIPTS OF INDUSTRY 100

MARKET PLACE 105

BPA

Copyright 1954 THE INDUSTRIAL PUBLISHING GROUP
(Division of Telenews Productions, Inc.)

Testing Anker-Holth Hydraulic Cylinder to be used on a metal stretch forming press. Cylinder on test is 16" bore, 69½" stroke, for 3000 psi operating pressure. Tested at 4500 psi.

Thorough testing of Anker-Holth Cylinders assures you dependable power

● Every Anker-Holth Cylinder . . . large and small . . . is tested at 150% of working pressure with the latest completely-filtered testing equipment. Anker-Holth testing facilities include portable units such as the one shown . . . also stationary equipment for pressures up to 10,000 psi.

This is one of the many safeguards in manufacturing to assure you top performance and dependability in Anker-Holth Cylinders. There's a type and size of cylinder to match *your* need. Anker-Holth engineering know-how is available to help solve your power motion problems. Call or write ANKER-HOLTH DIVISION of the Wellman Engineering Co., Dept. C-18, 2723 Conner St., Port Huron, Michigan.

FREE: *Bulletin on complete line of ANKER-HOLTH products.*

Anker-Holth
ENGINEERED CYLINDER POWER
WELLMAN

Division of THE WELLMAN ENGINEERING COMPANY

APPLIED

HYDRAULICS

Published by
INDUSTRIAL PUBLISHING GROUP
(A Division of Telenews Productions, Inc.)
1240 Ontario St. Cleveland 13, Ohio

IRVING B. HEXTER ..... President
LESTER P. AURBACH
..... Executive Vice-President
EDWIN M. JOSEPH ..... Vice-President

BUSINESS STAFF

BENNETT H. HORCHLER General Manager
WILLIAM L. JERSE ....Production Manager
EDWIN M. JOSEPH ....Circulation Manager
HAROLD BEHM .....Franchise Manager

SALES OFFICES

CLEVELAND 13 .....SUperior 1-9622
F. P. MIGNIN, Manager
R. D. SHATTUCK

NEW YORK 17 .....MUrray Hill 7-3420
LEE HAAS, Eastern District Manager
STEPHEN SHEPARD
ARTHUR L. GOEBEL
60 E. 42nd St.—Room 805

CHICAGO 11 .....WHitehall 3-1655-56-57
LLOYD WILLOUGHBY, Manager
S. R. TRACY
520 N. Michigan Ave.—Room 1613

LOS ANGELES 5 .....DUnkirk 9-9364
ALAN T. CAZIER, Manager
3460 Wilshire Blvd.—Room 1003

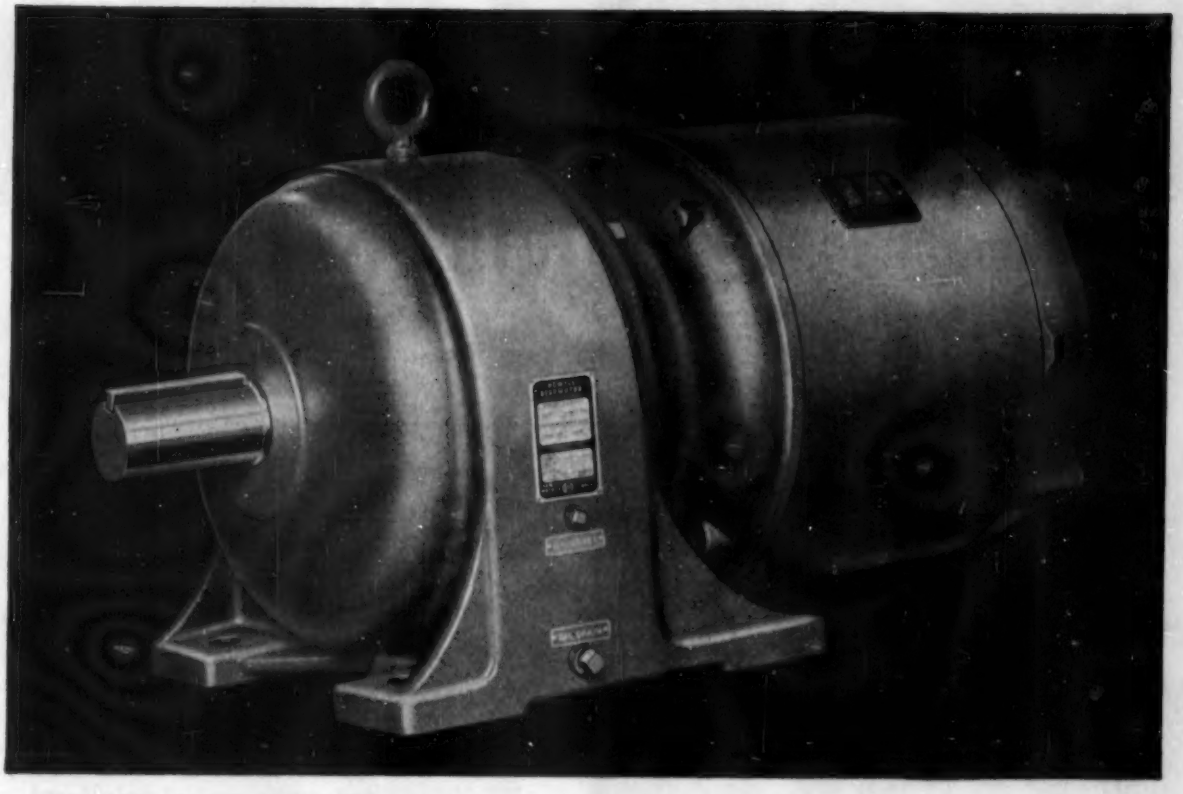
LONDON E.C.4 .....City 4815
JOHN A. LANKESTER, Manager
5 New Bridge St., Fleet Street

●

Also publishers of COMMERCIAL REFRIGERATION & AIR CONDITIONING, PRECISION METAL MOLDING, FLOW, INDUSTRY & WELDING and OCCUPATIONAL HAZARDS. Member, Business Publications Audit of Circulation, Inc.

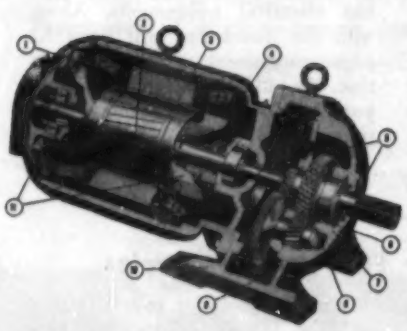
Subscription in United States and possessions—$3.00 per year; Canada—$4.00 per year; Foreign—$5.00 per year, except United Kingdom. United Kingdom subscription £1.10 per year, payable in Sterling to our London Office. Single copy price, 30 cents. All subscriptions subject to individual acceptance by the publisher

Published monthly, acceptance under Section 34.64 P.L.&R. authorized at Pontiac, Illinois.



The power you need at the speed you need it . . .

HOWELL GEAR MOTORS



11 reasons why Howell Gear Motors last longer, serve you better

1. High-quality insulation
2. Copper-clad rotor
3. Expert craftsmanship
4. High-quality coil varnish
5. Leakproof oil seals
6. Duti-Rated Lifetime Gearing
7. Unit case construction with integral bearing housings
8. Corner-mounted offset shaft
9. Large oil reservoir
10. Heavy, cast-iron construction
11. Superior cooling

New dependability, greater starting torque and top efficiency, with output speeds as low as 7.5 rpm. are now available in Howell Gear Motors.

This compact, single-unit motor may well be the answer to your gear reduction problems. Combining the finest in heavy duty industrial gearing with the best in motoring, Howell Gear Motors reduce drive failures and production downtime.

Howell Gear Motors use duti-rated, lifetime gearing, with file-hard tooth surfaces and tough, resilient cores. They are available in all types of enclosures, from 7.5 to 780 rpm. with a capacity range from 1 to 150 hp., in all three AGMA service classifications.

For full information on Howell Gear Motors, contact the Howell man in your area, or write the factory direct for Bulletin GM-1.

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

MOTORS FOR INDUSTRY SINCE 1915

APPLIED HYDRAULICS

Fluid Power Lines

Servo Regulated Pump Speed

Designers of electric-arc furnaces have applied a hydraulic circuit to solve the problem of positioning the heavy electrodes. Development of this equipment makes a fascinating story as written in this issue by C. W. Vokac, Whiting Corporation. The stages of development encompass design thinking and techniques over about 50 years—starting with mechanical drives.

As is so often the case, today's design is simpler than previous controls and does the job better. The history of this development parallels the stages of design which other industries have and are presently going through. You will also find that the present two pump circuit, which depends on a regulated speed of one pump, can be used to advantage on other machines. The variable speed pump acts to meter the flow of oil to the hydraulic cylinder.

Circuit Design

Machine tool builders have seen many model changes during the past 15 years. These changes have resulted in a large part because manufacturers of hydraulic, air and electric control components have brought out improved products. And, of course much of the improvement in component design is the result of demands made by the machine builder and the machine user. Out of such demands and needs come new and better machines.

Typical of the development trend in machine tools is the design of the National Acme chucking machines. In their article, engineers, Jim Smith and Harry Brown, detail the hydraulic and electrical component changes which have gone into the new design.

Smart Tool Designers . . .

. . . worked out the air operated loading devices described on page 72. These devices reduce the number of manual operations from 7 to 2 and cut overall machine cycle time as much as 80 percent. Manual loading and unloading was getting to take longer than actual cutting time. To reduce this "nonproductive" part of the cycle, electrically controlled air circuits were worked out.

New Reader Service Card

This issue has a new kind of reader service card. It is simple and easy to use. If you want more information on products shown in any ad or free literature and new product item, just write in the number which appears below the ad or item. You'll find reader service cards bound between pages 88 and 89.

January Directory Issue

Next month, your copy of APPLIED HYDRAULICS will provide a new Products and Manufacturers Directory. During 1955, this issue will give you sources for air, hydraulic and electrical components. Along with the directories will be a 32 page component application section. This illustrated section will tell you about sizes, construction, operation and design of components.

$1200 in Prizes for Fluid Power Articles

APPLIED HYDRAULICS Magazine's 1955 Prize Paper Contest is underway. Author of the best paper submitted before June 1st, 1955 will receive $500. Second prize is $300; third prize $200, fourth through seventh prize $50 each. And—payment will also be made to all authors of papers which merit publication. This means that if your article does not win a major prize you still can receive payment for your efforts.

What should you write? How should you prepare the article? Study any issue of APPLIED HYDRAULICS. Also study the October issues of 1953 and 1954 in which prize papers were published.

To enter the contest, write us for an entry blank. We'll also send you suggestions which will help you prepare your paper.

---

sealed **TIGHT,** sealed **RIGHT,** with a **Precision "O" Ring!**

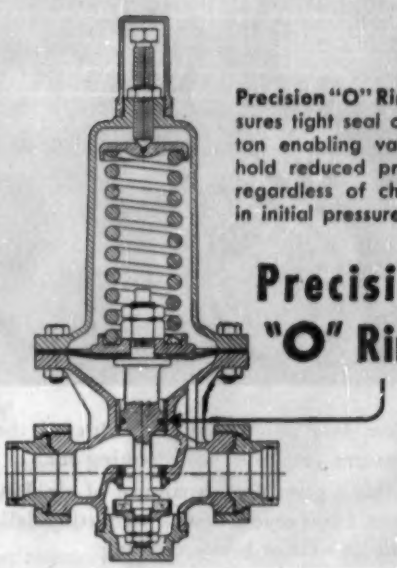
...this Atlas Reducing Valve

Atlas Fig. 191— Type "E" Reducing Valve

The Atlas Valve Co., Newark, N. J., has developed its Fig. 191-Type "E" Reducing Valve for initial pressures to 300 PSI, and reduced pressures from 5 to 125 PSI, on water, air or oil service. For a positive seal on the piston—less friction, better and longer service life at higher temperatures — Atlas Engineers specify **Precision** "O" Rings.

How about your sealing problem? Let our engineers help you solve it with **Precision** "O" Rings—tough, compression molded, rigidly inspected—finest "O" Rings made!

FREE—Handbook of "O" Ring data. Write for yours today.



Precision "O" Ring assures tight seal on piston enabling valve to hold reduced pressure regardless of changes in initial pressure.

Precision "O" Ring

Precision Rubber Products CORPORATION

"O" Ring and Dyna-seal Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio **Canadian Plant at: Ste. Thérèse de Blainville, Québec**

NEW CLECO
BREEZE•OR•BLAST
BLOW GUN

THIS BUTTON gives precision control of air flow. You can throttle down to a whisper and build up to a blast.
FOUR REPLACEABLE VALVES give perfect control of air flow at all times. One or more of the valves may be replaced by plugs if it is desired to limit maximum air flow.
Screen optional.
¼" or ⅜" openings available.

Here is a new blow gun with all the features you have been looking for.

First, it gives perfect control of air flow from a breeze to a blast—permitting delicate as well as heavy cleaning.

Second, it shuts off positively—preventing waste of air.

Third, it is easy to handle.

Fourth, all wearing parts are easily replaced.

Write or call for more information, or a demonstration.

HOSE CONNECTIONS AND NOZZLES AVAILABLE

Size Air Inlet	Size Nozzle	Code Number
¼"	⅜" — 24	850220
¼"	⅛" N.P.	850250
⅜"	⅜" — 24	850221
⅜"	⅛" N.P.	850251

CLECO AIR TOOLS

DALLETT

CLECO

Division of REED ROLLER BIT COMPANY

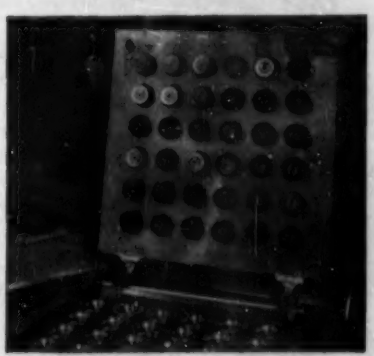
5125 Clinton Drive **Houston 20, Texas**

AIR TOOLS AND ACCESSORIES

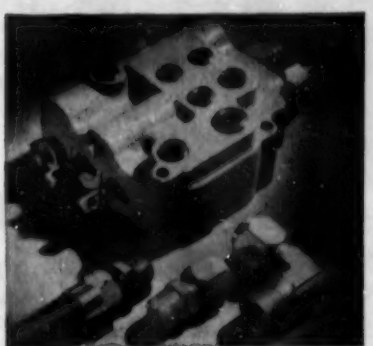
Grinders • Sanders • Rotary Drills • Riveters • Backfill Tampers
Chippers • Scaling Tools • Nut Runners • Impact Wrenches
Screwdrivers • Sump Pumps • Paving Breakers • Spike Drivers
Air Line Accessories and Fittings

4930

Laboratory and service tests check compound resistance to oils, fuels and chemicals at high and low temperatures ...assuring the long life of Parker O-rings.



Precision molding by exclusive, automatically controlled methods assures close-tolerance fits. Parker has molds for every *standard* O-ring size. Send for data.



What other Parker products interest you? *Triple-lok* flare tube fittings? *Fermlok* flareless tube fittings? *Hoze-lok* fittings? New hydraulic directional control valves?

Compare actual O-ring samples

Prove by comparison tests how Parker O-rings seal better and last longer

For trouble-free leakproof sealing, you can depend on Parker O-rings. They are precision molded of superior compounds that have been developed as the result of thousands of tests.

Elongation, tensile strength, compression set ratings, resistance to oils, fuels, chemicals, and high and low temperatures, are determined with care. Then, laboratory and service tests make sure that all rated characteristics are held.

From Parker you can get exactly the *right* O-ring for your *specific* application. We invite you to compare Parker O-rings with any other make. Our engineering service will also help you with designing problems.

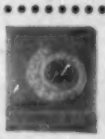
Send for complete engineering data today. Mail the coupon for your *free* data book or ask your Parker O-ring distributor for a copy.

RUBBER PRODUCTS DIVISION
The Parker Appliance Company
17325 Euclid Ave., Cleveland 12, Ohio
1538 So. Eastern Ave., Los Angeles, Cal.

Parker

Hydraulic and fluid system components

RUBBER PRODUCTS DIV.
Section 511-F
The Parker Appliance Co.
17325 Euclid Avenue
Cleveland 12, Ohio



☐ O-ring Catalog No. 5100
☐ Custom-molded Rubber Cat. No. 5201A1

Name_____ Title_____
Company_____
Address_____
City_____ State_____

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

PACKINGS . . . recommended for reciprocating and centrifugal pumps are given in a folder prepared by Johns-Manville. The ten types of packings shown have been developed to meet a wide range of industrial packing requirements. According to this folder coil and spiral packings are most economical for maintenance purposes because rings for many different stuffing boxes can be cut from the same coil and spiral. A table lists the best recommendations for a number of conditions and applications.

Fill in No. 150 on Reader Service Card

HONING OF CYLINDERS . . . to customer's specifications is American Hollow Boring Co.'s specialty. A four page bulletin describes and illustrates its facilities and examples of their products. Equipped to manufacture cylinders from 1¼ inch to 15 inch I.D. and 27 feet in length, they can be furnished in seamless tubing, with welded flanges and bases and from solid bar stock. Exacting tolerances and honed finish are rigidly maintained.

Fill in No. 151 on Reader Service Card

AIRCRAFT PUMPS . . . the story of their manufacture is illustrated in an attractive 20 page booklet entitled "The Lear-Romec Story". It describes and pictures the company's engineering and production facilities and its modern test equipment and scientific methods which insure the excellence of product. Two pages show the aircraft to which the company supplies their manufacture.

Fill in No. 152 on Reader Service Card

INDUSTRIAL OIL HYDRAULICS BOOKLET . . . is a handsome 22 page multi colored text published by Cities Service Petroleum, Inc. The first chapter gives a brief introduction to the meaning of hydraulics and its ever growing application in industry. The principles of hydraulics described and illustrated with drawings show how force is developed and the building of the system. Pumps, valves, accumulators and cylinders, fluid couplings, torque converters and typical hydraulic circuits are explained. The chapter on hydraulic oil stresses the seven important factors to consider in hydraulic oil selection, also covers filtering and cleaning procedures. A list of oils and recommended applications completes this booklet which should be a handy reference edition for those who design, operate and maintain industrial oil hydraulic equipment.

Fill in No. 153 on Reader Service Card

INSTALLATION ACCESSORIES . . . for hydraulic, air and lubrication applications are described in a 16 page catalog released by the J. N. Fauver Company, Inc. Catalog No. 17-D contains complete information and specifications on adapters, couplings, hose fittings, tube fittings, pipe fittings, hose couplings, hose clamps and snubber tools and many other accessories. Components are illustrated and a price list included.

Fill in No. 154 on Reader Service Card

FLEXIBLE COUPLINGS . . . which will connect electric motors to drive pumps, are described in an eight page catalog No. 55. It illustrates gear type couplings of standard and special types, Francke couplings, cut-out pulleys and junior gear coupling. The catalog, prepared by John Waldron Corporation, gives complete specifications such as working torque range, bore limits, dimensions and shipping weights.

Fill in No. 155 on Reader Service Card

ELECTRIC MOTORS . . . of the new Series 100 are the subject of Howell Electric Motor Company's new bulletin. This line of motors, re-rated according to new NEMA designs, introduces smaller frame diameters for a-c motors, 1 to 30 hp, saving considerable weight and space. It allows to get greater horsepower per frame size or use a given horsepower in a smaller frame size. The bulletin states that because of new improved insulation, better motor design and ventilation, heat is dissipated more effectively. The brochure includes dimensions and data of new frame sizes and the dimensions of old and new foot and flange mounted motors.

Fill in No. 156 on Reader Service Card

For more reviews of Free Literature turn to page 82

Fill in No. 31 on Reader Service Card

HYDRAULIC POWER
DELIVERED THROUGH
Eastman
HYDRAULIC HOSE ASSEMBLIES

•

TILTS 30 TON LOAD 70° IN 21 SECONDS

The Heil "High Angle" Hoist shown here is capable of elevating a 30-ton rock load 70° in 21 seconds . . . cutting overhead time and operating costs by quick, clean unloading in "round-the-clock," quarry operation.

Heil Truck Bodies and Hoists, known for their quality, durability and sound engineering—are likewise equipped with *quality* Hydraulic Hose Assemblies—by EASTMAN of Manitowoc, Wis.—first in the field of modern hydraulic power application.

Protect the performance of *your* product by relying on the high standards of quality and workmanship in EASTMAN Hydraulic Hose Assemblies. Safeguard *YOUR* Lifelines of Mobile Power, too!

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

WRITE for our Catalog 101 on Eastman Hydraulic Hose Assemblies

The tremendous lifting power of the Heil Hoist is obtained through twin cylinders and extremely powerful linkage—with only 1000 psi delivered through Eastman Hydraulic Hose Assemblies.

Eastman
first in the field
MANUFACTURING COMPANY
Dept. AH-12 Manitowoc, Wis.

Anthony Lift Gate

Anthony Lift Gate, built by pioneer company in truck lifts—equipped by Eastman, pioneer in hydraulic hose assemblies. Up to 4000 lbs. lift.

Drott Skid Shovel

Drott Skid Shovel, built for International, equipped with Eastman Hydraulic Hose Assemblies. Lift capacity —4000 lbs. Breakout force—11,500 lbs.

LOWERS LOADS smoothly

"WATERMAN FLOW REGULATORS . . .

control the flow of oil through the hydraulic lift and lowering mechanism"

Say Barrett-Cravens Company, manufacturers of handling equipment, who use WATERMAN FLOW REGULATORS in their powered industrial trucks. Pictured above is a Barrett Power Ox Electric truck in a Southern Coca Cola bottling plant. The hydraulic lifting and lowering mechanism is important in this application, especially for gently lowering large loads of bottled goods to the floor. WATERMAN FLOW REGULATORS do the job efficiently!

Wherever constant flow or fluid is required regardless of pressure or back pressure fluctuations WATERMAN FLOW REGULATORS are the answer. Easy-to-install, simplify circuits, reduce weight, space and cost. Available in a range of sizes and variety of models. Operating pressure to 3,000 P.S.I.

Write for latest illustrated bulletin A

WATERMAN ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

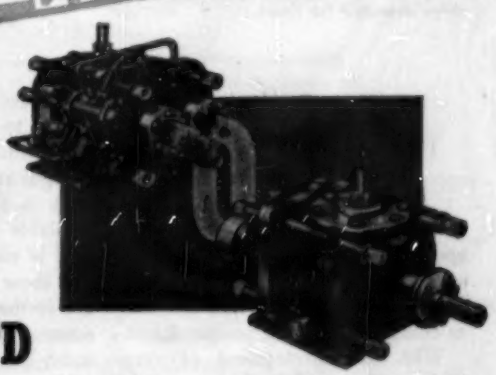
'VSG'

Serving Modern Industry

Regd. Trade Mark

Infinitely VARIABLE SPEED HYDRAULIC TRANSMISSION GEARS

Extensive new plant has recently been installed in Sheffield, England, by Firth Vickers and Samuel Fox. The above illustrations show one of the Pickling and Annealing Lines. For precise speed control over a wide range and for accurate synchronisation of each section drive 'VSG' Hydraulic Transmission Gears were selected.



VICKERS-ARMSTRONGS LTD

VICKERS HOUSE BROADWAY LONDON SWI ENGLAND Cables VICASTRONG LONDON

EAST: Consolidated Engines & Machinery Co. Ltd., 5645, Pare, Montreal, Quebec and 14th and Birmingham Streets, New Toronto, Ontario
WEST: Galbraith & Sulley Ltd., 1331 West 6th Avenue, Vancouver, 9

BRIEFS about fluid power

1954 APPLIED HYDRAULICS CONTEST WINNERS RECEIVE AWARDS AT NCIH LUNCHEON

Winners of the 1954 APPLIED HYDRAULICS Prize Paper Contest received their prizes from: I. B. Hexter, president, Industrial Publishing Group, at a luncheon held at the National Conference on Industrial Hydraulics. Hexter stated that this contest established in 1953, will be an annual event. The prize winning papers represented outstanding examples of design, application and operating techniques of fluid power.

Left to right: Julius Kendall, vice president, Greer Hydraulics Inc., accepted for Stampfl; I. B. Hexter; Lee Drasin; Nathan Cohn of the Leeds Northrop Chicago office accepted for Knorr.

Judges for this year's contest were D. G. Green, Chief Engineer, Williams-White & Company, F. L. Mackin, Chairman, Machine and Woodshops and Hydraulics, General Motors Institute and J. T. Marshall, Chief Engineer, Hamilton Division, Bendix Aviation Corporation.

First prize, $500, was awarded to Lee Drasin and Walter Stampfl, Greer Hydraulics, Inc., for their paper "How to Prevent Hydraulic Shock on Mobile Equipment". Second prize, $300, to Karl Schubert, The National Acme Company, for his paper "Oil Controlled Spindle Positioning Attachment". To Atlee Knorr, Leeds & Northrop Co., went the third prize, $200, for his paper, "Electric-Pneumatic System for Induction Hardening Equipment".

These prize winning papers were published in the October issue of APPLIED HYDRAULICS. ▼▼▼

High Speed Aircraft Pumps

Hydraulic aircraft pumps, developed by New York Air Brake Company, are being tested for operation at 10,000 revolutions per minute, as compared with the present 4,500.

With the development of very high speed aircraft in the supersonic range, according to Bernard Peyton, chairman of the board, a demand was placed on accessory manufacturers to produce smaller equipment which would operate at higher temperatures. Pumps which will work in 350 degrees Fahrenheit are available today, but the ultimate goal is much higher. Another problem these high speed airplanes create is that of size, which is often more important than weight. Toward this end the speed of accessories must be increased in order to get more horsepower into the same or smaller package. ▼▼▼

"Hydraulic Engineers Further the Art . . .

. . . of automation," observed Kurt O. Tech, chief engineer, Cross Company, Detroit, in a paper, delivered at the NICH in Chicago, October 14, on trends in the design of automation in the machine tool industry and the ability to control "down-time" because of unpredictable failures.

"To eliminate down-time" he said, "hydraulic engineers are called upon not only to continuously develop simpler circuits but also to coordinate their efforts with those of the machine designers and electrical designers in order to arrive

Continued on page 16

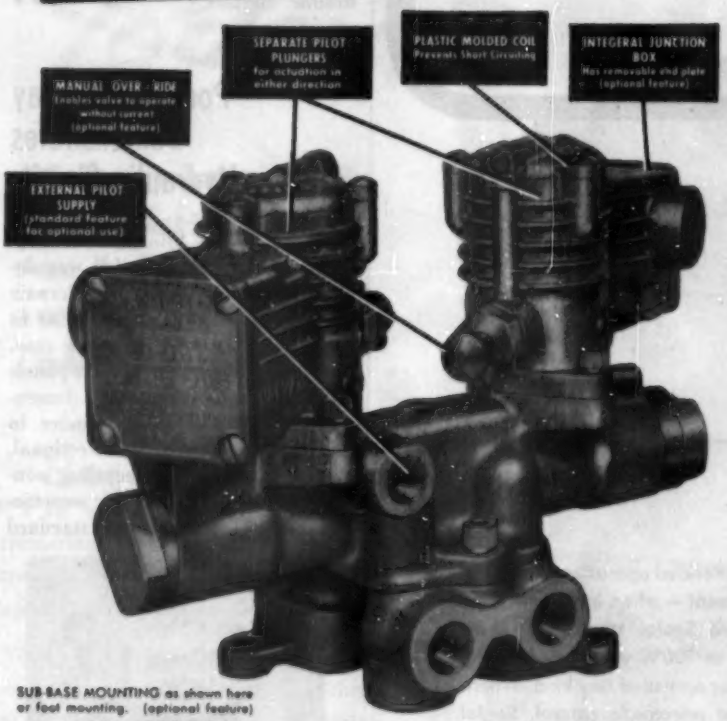
Automation Minded?

Valvair is proud to announce another advancement in the field of automation—The Double Solenoid Speed King Control Valve, designed especially for both the Original Equipment Manufacturer and the End User. This development proves that, more than ever before, Valvair is the name to keep in mind when you order solenoid-operated valves.

R. A. Reichelt
R. A. REICHELT
General Sales Manager

New SPEED KING CONTROL VALVE with DOUBLE SOLENOID

PERFORMS THROUGH MILLIONS OF CYCLES WITHOUT DANGER OF BREAKDOWN OR COIL BURN-OUT



SUB-BASE MOUNTING as shown here or foot mounting. (optional feature)

- 35 to 200 P.S.I.
- Vacuum to 300 P.S.I. (using external pilot supply
- Foot or Manifold Mounting in ⅜" size or ¾" size
- Compact
- Interchangeable
- Fully Enclosed
- 4-Way Body

DESIGNED & BUILT TO J. I. C. SPECIFICATIONS

The Double-Solenoid Speed King is the most rugged and compact valve made where speed, life and range of application are standards of comparison. SPEED: up to 600 cycles per minute for air service. LIFE: exhaustive tests show Speed King still operating millions of cycles over the 20 million mark. The life of this valve is further prolonged due to the fact that all parts are completely enclosed.

INTEGRAL JUNCTION BOX (Optional feature) Speed King is the only valve having a box cast with the housing of the pilot controls. Accessibility to electrical connections is provided for ease of installation and maintenance. The coils are molded, eliminating wear and shorts.

SIMPLICITY Only two moving parts: a single spool-type stem in the main valve body and the plunger in each pilot. No springs are used in the main valve, since air positions the stem in both directions. The solenoid pilot is removeable as a unit. Repacking can be done without disturbing the piping. One man can easily handle all phases of installation and maintenance.

MANUAL OVER-RIDE (Optional feature) This makes possible operation when electric current is off. Job set-ups can be made by one man without turning on the current.

VALVAIR offers both the ORIGINAL EQUIPMENT MANUFACTURER AND END USER A COMPLETE LINE OF AIR, VACUUM AND HYDRAULIC VALVES TO MEET ALMOST EVERY SPECIFICATION.

FIND OUT WHAT *New* DOUBLE SOLENOID CAN, DO FOR YOU

VALVAIR CORPORATION
951 Beardsley Ave.
Akron 11, Ohio

GENTLEMEN:

Please send me complete specifications and information concerning:

- ☐ The New Double Solenoid Speed King Valve
- ☐ Single Solenoid, Pilot-Operated, Speed King
- ☐ The Complete Valvair Line
- ☐ I prefer to have your representative call

NAME _____ POSITION _____

ADDRESS _____

CITY _____ STATE _____

Valvair

951 BEARDSLEY AVENUE • AKRON 11, OHIO

Affiliate: Sinclair-Collins Valve Company

Representation in: Baltimore • Birmingham • Boston • Buffalo • Charleston, W. Va. • Chicago • Cleveland • Cranford, N. J. • Dayton • Denver Detroit • Eureka, Calif. • Houston • Kansas City, Mo. • Logansport, Ind. • Louisville • Minneapolis • S. Pasadena • Philadelphia • Pittsburgh Portland • St. Louis • Seattle • San Francisco • Syracuse • Montreal • Toronto • Vancouver

Have you heard about

"AUTOMATION Shaft Sealing"

?

Automation demands unattended operation of hydraulic and pneumatic equipment — often in remote locations — and that's where Sealol Mechanical Shaft Seals pay off. These seals operate at 100% efficiency for long periods of time, without adjustment or service of any kind. Where process control means hydraulic or pneumatic control, Sealol makes the big difference between accurate performance and irritating maintenance. If you are designing servo-mechanisms, hydraulic controls and actuators, or pneumatic relays and positioners, check with Sealol on your shaft sealing problems. Our Engineering Department is ready to help you. Ask for new Bulletin 7, or write us for specific data and recommendations.

Sealol Corporation,
9 Willard Ave., Providence 5, R. I.

WHAT DO WE SEAL?

Pressures to 1500 psi., rubbing speeds to 15,000 fpm., operating temperatures to 500°F.

SEALOL

NEW YORK CITY • PHILADELPHIA
CHICAGO • CLEVELAND
HOUSTON • SAN FRANCISCO
LOS ANGELES • KANSAS CITY (MO.)
CHARLESTON (W. VA.) • ST. LOUIS
TULSA • EDMONTON — TORONTO, CAN.

THE BALANCED PRESSURE SEAL

BRIEFS

continued

at a completely integrated design which will operate with a minimum of down-time".

The importance of hydraulics was illustrated by showing a slide of a transfer machine in which there are approximately 109 separate hydraulic circuits. ▼▼▼

Portable Display Demonstrates Air-Hydraulic Circuits

Known as the "Board of Education", this portable display was designed and developed by Modernair Corporation. The unit, made to fit in an easily handled traveling case, consists of four 20 x 30 inch panels and an easel. The panels demonstrate an air-hydraulic cylinder in an operating circuit, its directional, skip-stop, speed and recycling controls; a complete automatic sequencing circuit composed of standard

components; basic types of pneumatic and low-pressure hydraulic control valves and cylinders manufactured by the company. One panel shows large scale section drawings highlighting design, construction features and wide range of applications of these components.

The displays are available for group demonstrations by Modernair representatives and dealers throughout the United States and Canada. Sales engineers will work out on-the-spot problems suggested by the audience. ▼▼▼

Send for this time-saving Anchor Wall Chart

Today!

Get concise, useful information fast on Anchor adapter unions, pipe fittings, and adapters

HERE'S an attractive, easy-to-read, 17" x 28" wall chart that gives you handy information in a hurry. It carries a complete listing of all commonly used Anchor adapter unions, pipe fittings, and adapters.

You get a quick summary of types available, catalog numbers, sizes, and thread data — everything you need to design, specify, or order — at a glance. Chances are you won't need to look any further, because the Anchor line is the largest and most complete available anywhere—and the chart shows every unit you ordinarily need.

Naturally there's no charge or obligation for this useful chart. Simply mail the coupon now and we'll see that this handy Anchor Wall Chart reaches you promptly.

Fill in this coupon and mail today →

ANCHOR COUPLING CO. INC.
Main Office and Factory • LIBERTYVILLE, ILLINOIS
Factory Branches:
377 Amelia Street, Plymouth, Michigan (In the Greater Detroit Area)
2100 Irving Boulevard, Dallas, Texas

Anchor Coupling Co. Inc.
Department AH124, Libertyville, Illinois
I'd like an Anchor Wall Chart. Send me one, pronto.

Name..... Title.....
Company.....
Address.....
City..... (.....) State.....
D-22

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

FIXED DISPLACEMENT PISTON PUMPS

. . . for high pressure applications

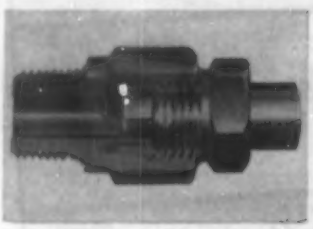
Designation: Model C-5 and Model C-11

Design: In these radial piston pumps each piston assembly is completely surrounded by high pressure lubrication. Bearing assembly, featuring heptagonal bearing races, insures minimum friction, provides maximum area of contact at points of piston actuation.

Specifications: Model C-5 delivers 5 gpm at a maximum pressure of 10,000 psi, requires 38 hp input at maximum pressure. Model C-11 delivers 10 gpm at maximum pressure of 5,000 psi, requires 35 hp at maximum pressure.

Simplex Engineering Co.
Zanesville, Ohio

Fill in No. 115 on Reader Service Card



FITTINGS

. . . flare tubing automatically

Designation: Flare-Matic

Features: These fittings eliminate the need for preflaring the tubing. No flaring tools are used, tube is inserted into the fitting, tightens nut with ordinary wrenches. Mated surfaces of tube and internal flaring cone assure leak proof connection.

Construction: Made of brass, monel, cadmium plated steel, stainless steel or anodized aluminum.

Applications: For pneumatic and hydraulic tools and equipment, machinery and plant lubrication applications, test, maintenance and service equipment.

Sizes: Available in ¼, ⅜ and ½ inch O.D. tubing.

Century Products
Philadelphia, Pa.

Fill in No. 116 on Reader Service Card

AIR & HYDRAULIC VALVES

. . . have interchangeable controls

Designation: Hi-Cyclic

Feature: This line of manually, mechanically and pilot actuated valves is available in all normally used actuators such as hand lever, fingertip or foot lever, piloted and cam roller. These actuator assemblies can be quickly and easily mounted to the basic valve body due to snap-on construction. Mounting brackets and actuators may be rotated 90, 180 or 270 degrees for mounting and operating the valve in any position.

Sizes: ⅛, ¼, ⅜ and ½ inch for use with air, ⅛, ¼ and ⅜ inch for oil and water hydraulics.

The Beckett-Harcum Company
Wilmington, Ohio

Fill in No. 117 on Reader Service Card

For more NEW PRODUCT reviews turn to page 90

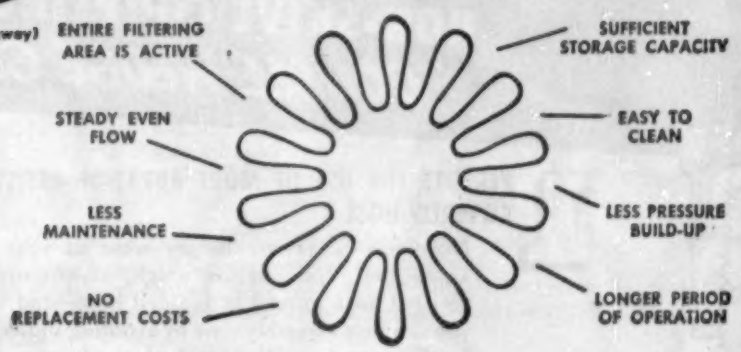
SUMP TYPE (Cutaway)

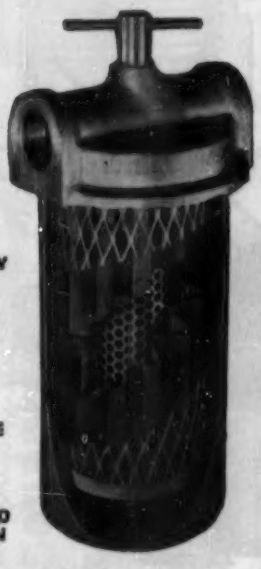
When You Need A Filter— Get The Advantages Of Marvel SYNCLINAL Design

It's BALANCED

For Top Performance!

LOOK FOR THESE IMPORTANT FEATURES





LINE TYPE (Cutaway)

For All Hydraulic and Other Low Pressure Liquid Systems

In the selection of a filter to obtain maximum efficiency and quality, the most important point to consider is a specific type filter that will offer greatest ACTIVE filtering area with ample storage capacity for filtered out particles, rather than total filtering area alone. Over 500 Original Equipment Manufacturers install Marvel Synclinal Filters as Standard Equipment because they are designed to give this all-important balance for greatest efficiency in filtration of liquids in all hydraulic and other low pressure circulating systems. Flow of liquids is maintained at a constant, steady rate of speed produced by the pump which brings about the desired effect of a gentle, evenly distributed accumulation of filtered out particles against the entire filtering surface with less restriction of flow. Result—longer periods of productive operation at minimum maintenance down-time. If this important balance is lacking due to efforts to cram too much filtering mesh for the sake of total rather than active area, filters soon become clogged causing pressure build-up, turbulent flow and in general decreases the efficiency of operating equipment. Depend on Marvel Synclinal Filters For All Your Filtration Requirements.

EASY MAINTENANCE

Both sump and line types may be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be obtained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

FILTERS FOR NON-FLAMMABLE HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of non-flammable hydraulic fluids.

Catalogs containing complete data available on request

IMMEDIATE DELIVERY!

As in the the past, Marvel continues to offer IMMEDIATE DELIVERY.

MARVEL ENGINEERING COMPANY

625 W. Jackson Blvd., Chicago 6, Ill., Phones: FRanklin 2-3530 & FRanklin 2-4431

Without obligation, please send me complete data on Marvel Synclinal Filters, as follows:— AH-12

☐ Catalog #106—For Hydraulic Oils, Coolants and Lubricants
☐ Catalog #300—For WATER
☐ Data on filters for Non-flammable hydraulic fluids.

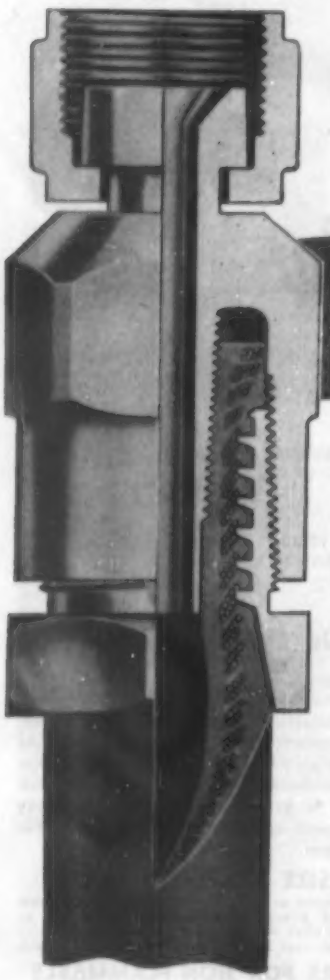
Name ..... Address .....

Title ..... City .....

Company ..... State .....

ANNOUNCING— JOY SURGEPRUF

HYDRAULIC HOSE and RE-USABLE COUPLINGS



The NON-SKIVE COUPLING with the "DOUBLE-WEDGE GRIP"

1 PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Now you can *insure* longer wear in your hydraulic hose assemblies! You can use tough, abrasion-resistant, rubber-covered hose instead of braided hose—and at the same time you can save assembly time by avoiding old-fashioned skiving. Joy Surgepruf couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you secure the extra long-wearing qualities of rubber-covered Surgepruf Hose without any need for skiving the hose at the connection.

2 NO SPECIAL ASSEMBLY TOOLS REQUIRED

No mandrels or other special tools are required to make up Surgepruf assemblies . . . no extra expense or special technique is involved.

3 CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Write for Bulletin H-100

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively.
Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa.

Consult a Joy Engineer

OFFICES: Birmingham • Boston • Chicago • Cleveland • Dallas
Denver • Duluth • El Paso • Forty Fort, Pa. • Huntington, W. Va.
Knoxville • Los Angeles • New York • Pittsburgh • St. Louis
Salt Lake City • San Francisco • Washington, D.C.

W&D HS429

JOY

HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

Fill in No. 51 on Reader Service Card Fill in No. 85 on Reader Service Card →

Safety X5 Series
Only 3 1/16" High

VERSATILE AND VIGILANT!

Low-Cost, Explosion-Proof SKINNER Solenoid Valve Underwriter Approved for Gas Vapors, Carbon and Grain Dust Applications

For hazardous locations, specify the Skinner Safety X5 Series Valve. It's Underwriter Approved for Class I, Group D, and Class II, Groups F and G. And no other explosion-proof valve has the simplicity and flexibility of the X5 design!

Skinner Safety X5 Series valves are skillfully engineered to give trouble-free operation through [illegible]. They are direct acting, spring loaded, *leakproof* . . . and give positive performance in any position.

Valves of this series have stainless steel internal parts and are offered in five basic types: two- and three-way normally open; normally closed; and directional control. They are available with a broad selection of electrical outlets, port locations and sizes, flow adjustments and coil types.

Media — Air, gases, vacuum, oil, water and many semi-corrosive media.

Pressure Rating — 0-1000 p.s.i.

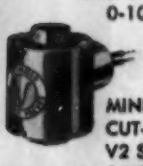
Construction — Leakproof sealing, bubble-tight shut-off at all ports; packless, frictionless construction; precision-machined stainless steel internal parts; electronically-controlled, pressure-tested welds.

Simplified Servicing — can be disassembled and repaired without removal from the line.

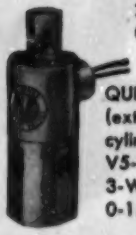
Specifications — *Duty Cycle* — continuous or intermittent.
Orifice Diameters — 3/64" to 1/4".
Pipe Size — 1/8" or 1/4" NPT.
Voltage — all common AC and DC voltages.
Power Consumption — 10 watts.

Do you have a special solenoid valve problem? Rely on Skinner's nationwide resident engineers and highly-skilled Skinner plant engineers to give you expert assistance and service. And for prompt delivery, count on your nearby Skinner stocking distributor.

GENERAL SERVICE & VACUUM
V5 Series
2- & 3-Way
0-1000 p.s.i.



MINIATURE CUT-OFF
V2 Series
2-Way
0-250 p.s.i.

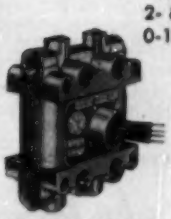


QUICK EXHAUST
(extra fast cylinder return)
V5-3 Series
3-Way
0-150 p.s.i.

HI-PRESSURE HYDRAULIC
V10 Series
2- & 3-Way
0-1000 p.s.i.

SANITARY
V4 Series
2-Way
0-20 p.s.i.

EXPLOSION-PROOF
X5 Series
2- & 3-Way
0-1000 p.s.i.



ALL-PURPOSE FOUR-WAY
V9 Series
4-Way 0-150 p.s.i.

HI-FLOW INDUSTRIAL
M Series
2- & 3-Way 5-150 p.s.i.

World-Wide Representation — Immediate Delivery on Standard Valves

SKINNER SOLENOID VALVES

SKINNER ELECTRIC VALVES

SKINNER ELECTRIC VALVE DIV.
The Skinner Chuck Company
105 Edgewood Avenue, New Britain, Connecticut
Please send us your bulletins on the following Skinner valves:

.....
.....
Please have a Skinner representative call on (date)
.....
Name.....
Company.....
Street.....
City.....*Zone*....*State*.....

THE CREST OF QUALITY

Qualifying for use on Air Force and Navy aircraft, this 3,000 lb. MIL-AN-6248 hydraulic hand pump, manufactured by GLADDEN PRODUCTS CORP., 635 W. Colorado, Glendale 4, Calif. underwent a test of 70,000 full cycles—only one change of "O"-Rings was allowed, and volumetric efficiency had to stay at not less than 75%. *The pump, however, equipped with Parco "O"-Rings, finished the rigorous test with a remarkable efficiency rating of 97.8%—with no change of "O"-Rings!* Another example of the extra durability of Parco "O"-Rings—it pays off in better products, greater efficiency and lower costs! All dash numbers of AN 6227, AN 6230, AN 6290, MS 29512 and MS 29513 series for commercial or Army-Navy installations to Specifications MIL-P-5516A, MIL-G-5510A and MIL-P-5315A are available from stock. Silastics and other special compounds supplied on order.

Now 8-page catalog and engineering data on request. Write us today.

Parco

PLASTIC AND RUBBER PRODUCTS CO.

2100 Hyde Park Boulevard, Los Angeles 47, California
3140 West Irving Park Road, Chicago 18, Illinois

LETTERS to the Editor

High Pressure Air Valve

We have been searching for a small, closed-center 3-way valve with about ⅛ inch orifice for controlling air at 1000 psi. Most hydraulic valves are not suitable for high pressure air or gas because they depend either on lubrication or metal-to-metal fits which would leak excessively under high air pressure. We also feel that for high pressure air a poppet valve would give better service than a sleeve or spool type. We understand that there is a trend toward high pressure pneumatics in aircraft controls and we would appreciate your giving us names of some manufacturers of control valves for these systems.

GEO. H. PFEFFERLE,
Technical Director,
Dresser Industries, Inc.,
Dallas 1, Texas

We do not know of any valve manufacturer that makes such a valve as a standard unit. We believe you are right that such a valve should be a poppet type. Some of the companies that have been supplying high pressure air equipment to aircraft builders, such as Walter Kidde & Co., Belleville, N. J. may be able to help you. Dwight Leach, Staff Engineer, Controls and Hydraulics Staff Group, at Chance Vought Aircraft, Dallas can make suggestions. Or we suggest that you get in touch with the Texas representative of the Ross Operating Valve Co., The Wendler Company, 335 AM & M Bldg., Houston 2, Texas.

Hydraulic Equipment for Large Planer Table

We have an inquiry for hydraulic equipment to operate the table of a large size planer. Our client emphasizes that table reversal must be very

Continued on page 26

FOR PRESSURES UP TO 5000 P.S.I.

HYDRAMITE

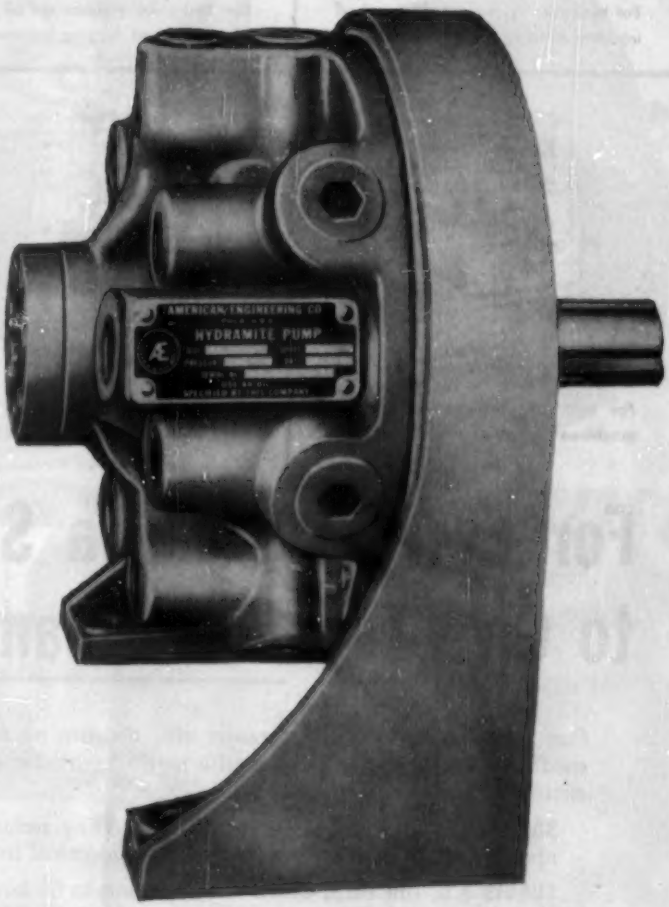
IS TODAY'S BEST PUMP... AND COSTS LESS

IN THE FEW YEARS since the Hydramite Pump was introduced it has become the top choice for an ever-increasing range of hydraulically-operated equipment... and has unfailingly brought the efficiency and economy which are always associated with products of the American Engineering Company.

The Hydramite Pump is available in a variety of sizes... develops pressures up to 5000 p.s.i. It operates on any of the makes and viscosities of oil which are suitable for hydraulic circuits.

• • •

Write for folder giving full information on the unique Hydramite Pump... and call on AE engineers or representatives for recommendations regarding possible applications.



WHEN IT'S HIGH PRESSURE, IT'S **AMERICAN!**

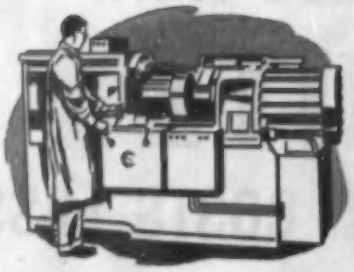
AMERICAN ENGINEERING COMPANY
PHILADELPHIA 25, PENNA.
IN CANADA: AFFILIATED ENGINEERING CORPORATIONS, LTD., MONTREAL 2, CANADA

AE Products are: Taylor and Perfect Spreed Stokers, Marine Deck Auxiliaries, Helo-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

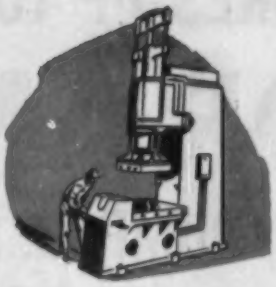
American Engineering Company
2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Kindly send me complete information about the Hydramite.

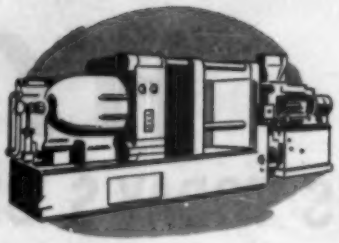
Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....



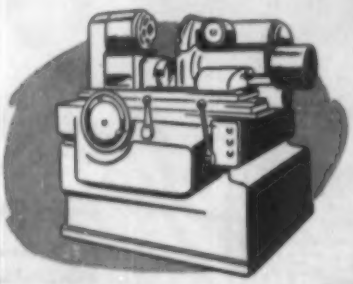
For hydraulic systems on all types of injection molding machinery.



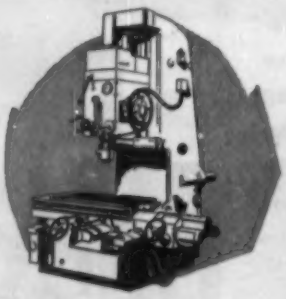
For hydraulic systems on all types of presses and forging hammers.



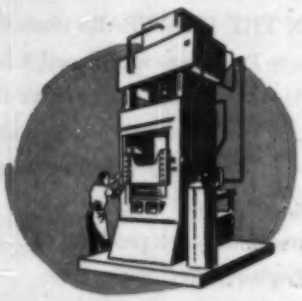
For hydraulic systems on all types of plastics molding equipment.



For hydraulic systems on grinding machines and other production tools.



For hydraulic systems on jig borers and other metalworking machinery.



For hydraulic systems on standard and special heavy-duty forming presses.

For Every System, a Sun Hydraulic Oil to Give Top Performance and Economy

Sun makes a variety of hydraulic oils, because *no single oil will meet all combinations of conditions economically.* Among the many hydraulic oils made by Sun the following cost-cutting products are typical.

SUNTAC OILS. Designed to cut leakage. They reduce it an average of 35%—and results are immediate. But they wouldn't be economical in a tight system.

SUNVIS H.D. 700 OILS. Clean dirty systems in 50 hours or less without loss of production. But they wouldn't be economical in systems that leak badly.

NEW SOLNUS OILS. Resist oxidation, prevent rusting and corrosion. They are low in cost and have long service life. But they wouldn't be economical in systems where excessive contamination is a problem.

Among the many different hydraulic oils made by Sun, there's one that's best for your system—a hydraulic oil that will give top performance at lowest possible cost. Consult your local Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-12.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

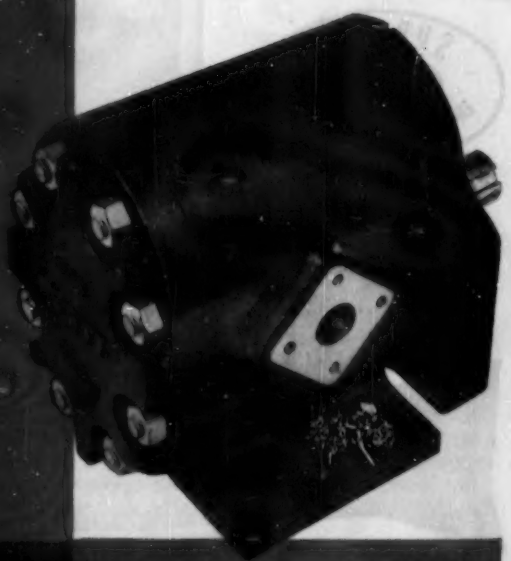
SUNOCO

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of the famous Blue Sunoco Gasoline and Dynalube Motor Oils

Hydraulics for Industry

These high pressure gear pumps have rendered hydraulic operation more accessible to the wide fields of industry. British designed, with British and overseas patents pending, they provide the vital source of hydraulic power at low cost.

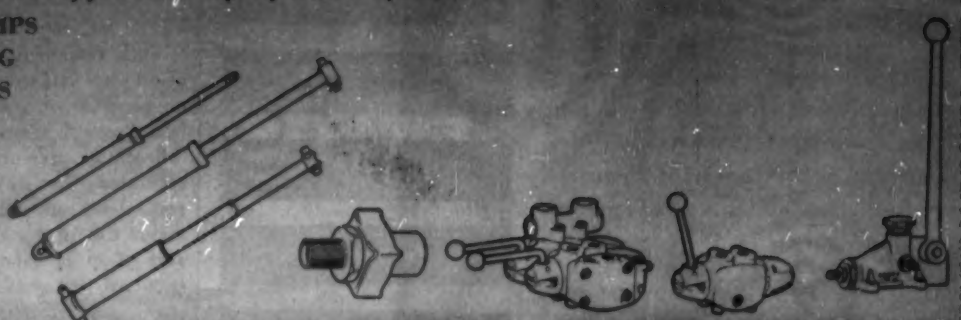


DOWTY
PRESSURE BALANCED
gear pumps

CAPACITIES
from 1 to 50 galls./min.
PRESSURES
up to 2,500 lb./sq.in.
VOLUMETRIC
EFFICIENCY — 94%

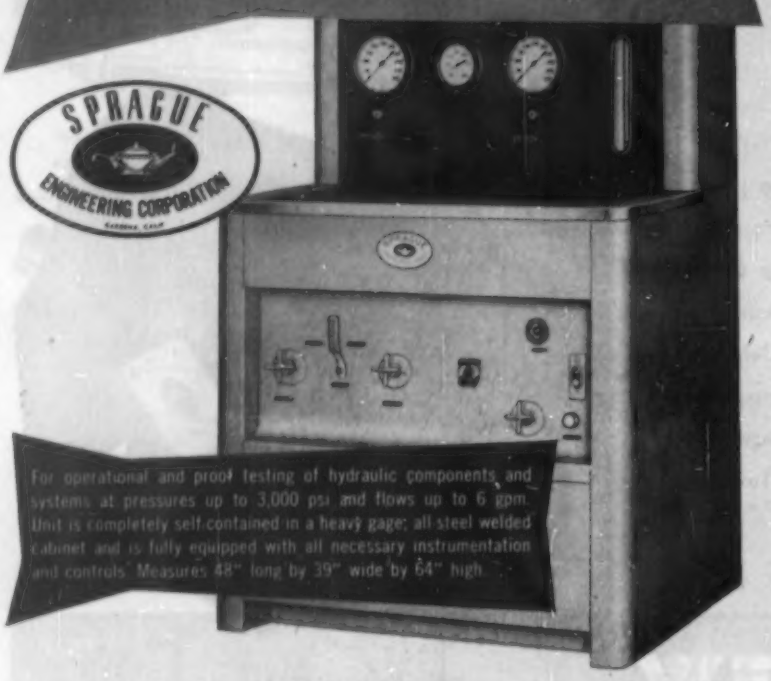
Broadening the application of hydraulic power:—

DOWTY PUMPS
SELF-SEALING COUPLINGS
CONTROL VALVES
HYDRAULIC RAMS



DOWTY HYDRAULIC UNITS LTD · ASHCHURCH · GLOS · ENGLAND
Member of the DOWTY Group

Now...a "Sprague-Quality"
HYDRAULIC TEST STAND
at a new low cost


SPRAGUE
ENGINEERING CORPORATION
For operational and proof testing of hydraulic components and systems at pressures up to 3,000 psi and flows up to 6 gpm. Unit is completely self-contained in a heavy gage; all steel welded cabinet and is fully equipped with all necessary instrumentation and controls. Measures 48" long by 39" wide by 64" high.

● Everyone who must test hydraulic components and systems to rigid standards will welcome the new Model S-1000. A small but complete test stand, it retains the same quality construction and materials of larger Sprague machines costing many thousands more. Unit is complete and ready for immediate service. *Flow control valve, flowmeter and oil cooling circuit included as standard equipment.*

Features:

- Controls out in front; easy to reach. Work does not get in the way.
- "Toe-under" front base panel for greater comfort, less scuffing.
- 15 gal. reservoir capacity with filter element.
- Constant flow piston type pump.
- For easy access, pressure outlets are located at forward part of tray.
- Pressure outlets point in, away from the operator.

Small manufacturers and overhaul stations will find that this one stand meets all their requirements. Large operators will order several units to keep multiple production lines moving. Write today for complete information and name of nearest representative.

SPRAGUE
Engineering Corporation
1144 West 135th St., Gardena, California

Letters to the Editor

Continued

fast and that a wide range of forward and reverse speeds should be possible. I would appreciate if you could give us the names and addresses of manufacturers of hydraulic equipment to do such a job.

JOHN R. HONEGGER,
Rutherford, N. J.

Hydraulic equipment of the type you would require for operating the table of a large planer could be obtained from the Oilgear Company, 1564 West Pierce St., Milwaukee 4, Wis. and Vickers, Inc., 1474 Oakman Blvd., Detroit 32, Mich. Both of these companies have offices and trained representatives in Northern New Jersey.

Data List

If available, kindly forward one copy of the current edition of APPLIED HYDRAULICS Data List. I am primarily interested in manuals, handbooks and catalogs in pneumatics.

J. M. MORRISON,
Trenton 9, N. J.

The new 1955 APPLIED HYDRAULICS Data List is now ready and a copy is being sent to you. Because of your interest, we would like to call your attention particularly to Section 2, Basic Information—Pneumatics, particularly the "Beginners' Course in Basic Pneumatics".

Replacement Signal for Oil Filters

With reference to your problem of oil filter replacement as described on page 20 of your October 1954 issue, may I suggest the use of a differential pressure switch as the controlling device? This type of control measures the pressure drop across the filter and when this pressure drop deviates from a preset standard, the switch closes, actuating whatever device may be required. These pressure differential switches are commonly used as protective devices on refrigeration and air conditioning systems and

Continued on page 28

Hydraulic Engineers agree...

it's UCON hydrolubes FOR SAFETY

Trade-Mark

here's why...

Ucon hydrolubes are Carbide's water-base hydraulic fluids. Water is the key to non-flammability.

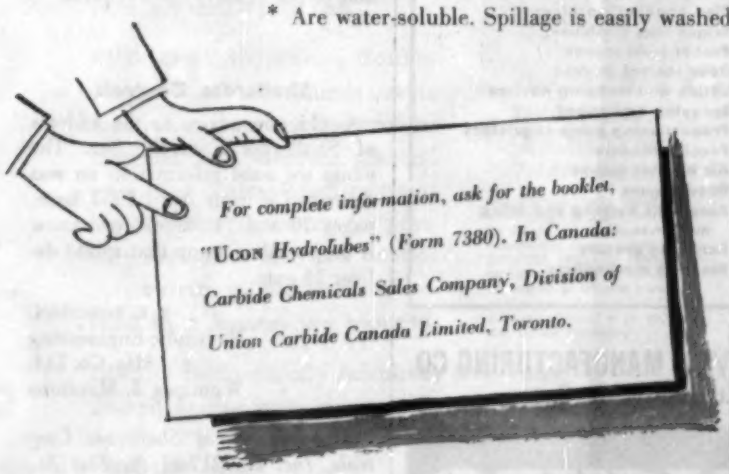
Resistance of Ucon hydrolubes to burning has been proved by years of severe, exhaustive testing in the laboratory. And, in *actual service*, Ucon hydrolubes have prevented fires and serious damage during their more than 6 years of routine use.

To get this kind of protection, switch to Ucon hydrolubes. Changing over is simple—drain the old fluid from your system, follow the cleaning procedure that Carbide recommends, and refill—no need to revamp your equipment, since . . .

UCON hydrolubes...

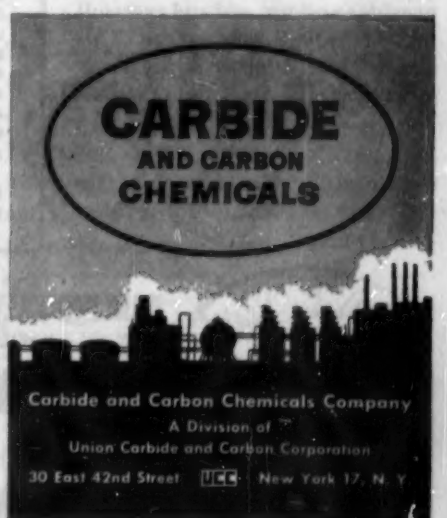
Trade-Mark

* Have no harmful effects on packings and seals. Leakage losses are often lower than with regular hydraulic fluids.
* Contain effective liquid- and vapor-phase corrosion inhibitors for the common metals.
* Have good lubricity. Special anti-wear agents provide satisfactory pump life and performance characteristics.
* Are made in 3 viscosity grades—200, 300, and 550 S.U.S. at 100°F. Other viscosity grades can be supplied to fit specific requirements.
* Have high viscosity indexes—150 to 160.
* Have low pour points—below minus 55°F. Ucon hydrolubes flow readily at low temperatures.
* Are non-toxic for all practical hydraulic purposes.
* Are water-soluble. Spillage is easily washed away.



For complete information, ask for the booklet, "Ucon Hydrolubes" (Form 7380). In Canada: Carbide Chemicals Sales Company, Division of Union Carbide Canada Limited, Toronto.

"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.



PRESSURE UP! COSTS DOWN!

Slippage Reduced
in PUMPS
AIR CYLINDERS and
HYDRAULIC CYLINDERS
with
DARCOVA PUMCUPS

Cross section showing Pumcup installed.

NORMAL wear of ordinary packing reduces efficiency to a tremendous degree.

In contrast, Darcova Pumcups actually retain their efficiency . . . and they outlast most other packings at least 3 to 1!

Their scientific construction makes it possible to reach *and hold* peak efficiency. Under pressure Pumcups hug the cylinder walls to provide a uniform seal and exert full pressure where it is needed. This means reduced slippage, lower power costs and far less maintenance.

Write for helpful data-and-proof bulletins: No. 4502 on Pumcups for air and hydraulic mechanisms; No. 4401 on Pumcups for reciprocating pumps.

Cost-minded engineers in many industries have standardized on Pumcups to solve their packing problems. The list of successful applications includes the following installations:

- Die casting machines
- Forming and drawing presses
- Straightening presses
- Pipe bending machines
- Briquetting machines
- Pusher mechanisms
- Door control devices
- Lifting and dumping devices
- Spraying equipment
- Proportioning pump regulators
- Recoil cylinders
- Air booster pumps
- Grease guns
- Automatic bottling and filling machines
- Extrusion presses
- Steering mechanisms

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 15, PA.

PUMCUPS

Letters to the Editor

Continued

have proved most reliable. Such switches are available for both large and small pressure drops and cost less than $30.00.

E. SPENCER,
Graham Mfg. Co. Inc.

Thank you, Mr. Spencer. We are sure that Mr. K. M. Gebel of the Engineering Department of Landis Tool Co., who had asked the question, and many others of our readers will appreciate this information.

Training Films

We are presently preparing a training program on Hydraulics for our maintenance personnel. Could you advise us as to what films or other visual aids may be available to us for this purpose?

E. V. TIDWEL,
Training Supervisor,
Aluminum Company of America,
Edgewater, N. J.

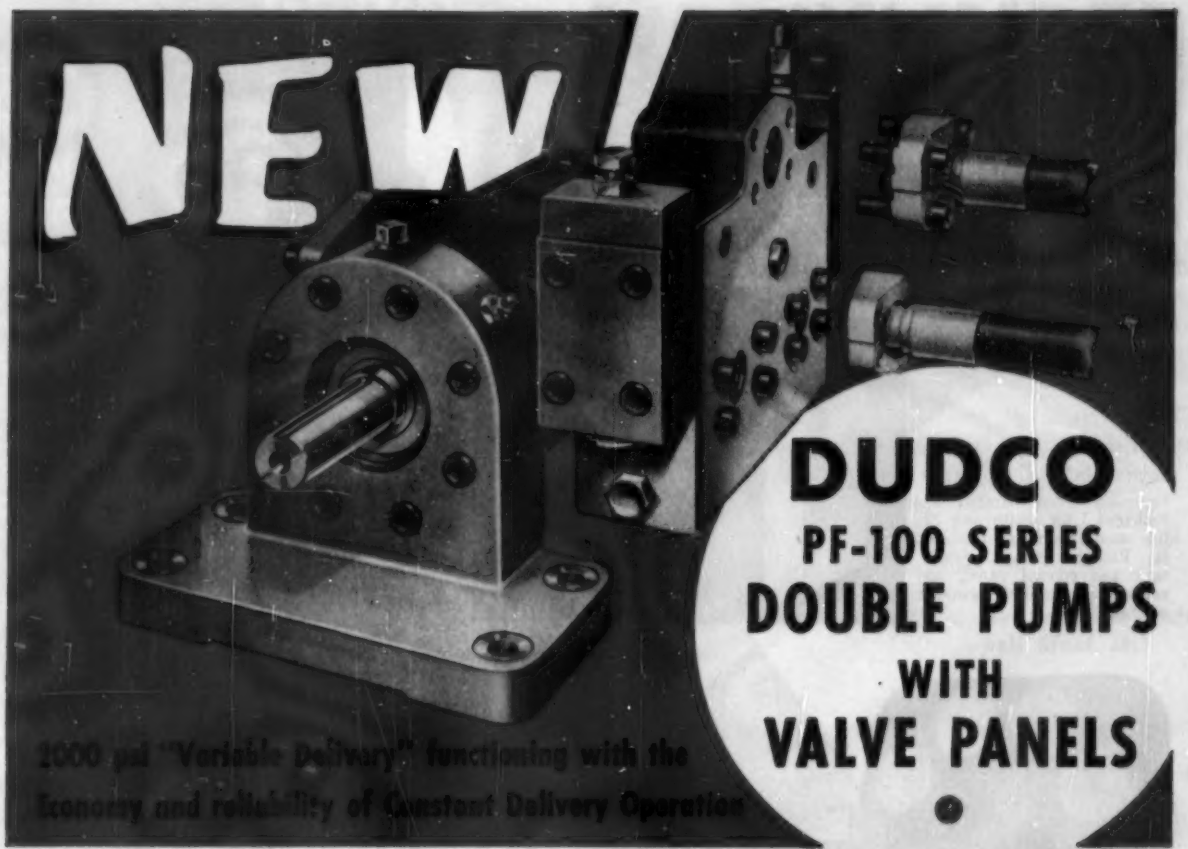
We have nearly ready a film, film slide and other visual aid list, prepared in a manner similar to our Data List. One of the first copies to be ready will be sent to you. NOTE: This list will be ready sometime in December and copies will be available to our readers upon request.

Shallcross Controls

Could you advise us the address of Shallcross Controls, Inc. The pump we want information on was described in your April 1953 issue, pages 70 and 71. Would you know if they make a pump that would deliver 15 gpm.

R. E. ROBINSON,
Hydraulic Engineering
Mfg. Co. Ltd.
Winnipeg 4, Manitoba

The address of Shallcross Controls, Inc. is 2217-21 N. 31st St., Milwaukee 8, Wis. Mr. John A. Morrow can give you complete information on this pump and the available capacities.



DUDCO
PF-100 SERIES
DOUBLE PUMPS
WITH
VALVE PANELS

DUDCO PF-100 Series Double Pumps with Valve Panels are versatile. They furnish *Fluid Power*, at continuous pressures to 2000 psi, either to two separate systems or to a single two-pressure circuit, controlled automatically in response to working pressures or remotely thru a pilot line.

DUDCO PF-100 Series Double Pumps with Valve Panels assure top system economy. They can be installed with almost "plug-in" ease. The Valve Panel contains the elements necessary for pressure regulation and flow control . . . valves, piping and connections in a system are reduced.

DUDCO Hydraulically Balanced, Dual-Vane Design Pumps give long, maintenance-free service at all pressures up to 2000 psi; with cost equal to that of low pressure pumps.

DUDCO PF-100 Series Double Pumps with Valve Panels insure maximum circuit efficiency . . . only fluid required for effective circuit operation is pressurized. Wasteful by-passing of unneeded fluid is eliminated . . . horsepower is saved and fluid heating reduced. The regulator valves are internally piloted . . . this superior design allows more accurate adjustment and provides better control over a wider pressure range without the danger of spool sticking or over-pressurization.

TWO VANES ARE BETTER THAN ONE!

The hydraulically balanced DUAL-VANES in DUDCO Hydraulic Pumps as contrasted with conventional designs, maintain MULTIPLE AREAS OF CONTACT ON THE CAM RING . . . doubling the number of effective barriers to slippage and power loss. This patented principle is an exclusive DUDCO feature!

DUDCO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1704 EAST NINE MILE ROAD • HAZEL PARK • MICH.

DUDCO DIVISION—
THE NEW YORK AIR BRAKE CO.
1704 EAST NINE MILE ROAD
HAZEL PARK, MICH.

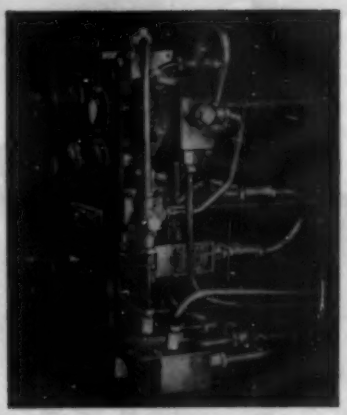
I would like more information about the DUDCO PF-100 Series Double Pumps with Valve Panels. Please send me Bulletin No. DP-308.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

"Fingertip-control" OF HYDRAULIC PRESSURE

WITHOUT SOLENOIDS OR OTHER ELECTRICAL GADGETS

Packaged Unit comprising 22 h.p. motor mounting two Axial Plunger pumps, supply tank and control panel, operating pre-stressed concrete machine.



Fully hydraulic push-button control panel for a 100 ton Cartridge Case Drawing Press.

Control Desk for 500/500 ton Downstroking, Prefilling Press.

Any desired pressure is "at your fingertips" when operating the Autodraulic Control System —and without solenoids! Already giving consistent and unfailing performance throughout N. America in a wide variety of applications, the Autodraulic Control System cannot fail to give increased performance and greater economy in *your* plant.

AUTODRAULIC
CONTROL SYSTEMS

WITH HYDRAULIC PUSH BUTTONS

TOWLER BROTHERS (PATENTS) LTD. • RODLEY, NR. LEEDS • ENGLAND

Sole Agents U.S.A. and CANADA

MACMILLIN ENGINEERING CORPORATION

2125 HOWARD STREET, CHICAGO 45, ILLINOIS

Ambassador 2-1191

Fill in No. 97 on Reader Service Card Fill in No. 61 on Reader Service Card

Miller AIR CYLINDERS

In "Custom-Built" and "Stock" Models

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

BRASS BARRELS
Eliminate Rust and Corrosion

Immediate Delivery on "Stock" Models

Rapidly expanding list of Miller "Stock" Cylinders for *immediate, off-the-shelf delivery* now includes *thousands* of different combinations of bore, stroke and models and covers both hydraulic and air cylinders—cushioned and non-cushioned.

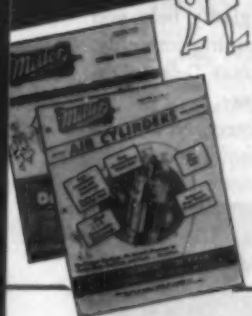
These are in addition to Miller "Custom-Built" Cylinders available on normal scheduled delivery in an *almost infinite selection.*

"Stock" Boosters also available for immediate delivery.

Write for Complete Catalog and Stock List

MET J. I. C. PNEUMATIC STANDARDS years before their adoption in 1950.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.



WRITE FOR CYLINDER BULLETINS A-105 and H-104

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

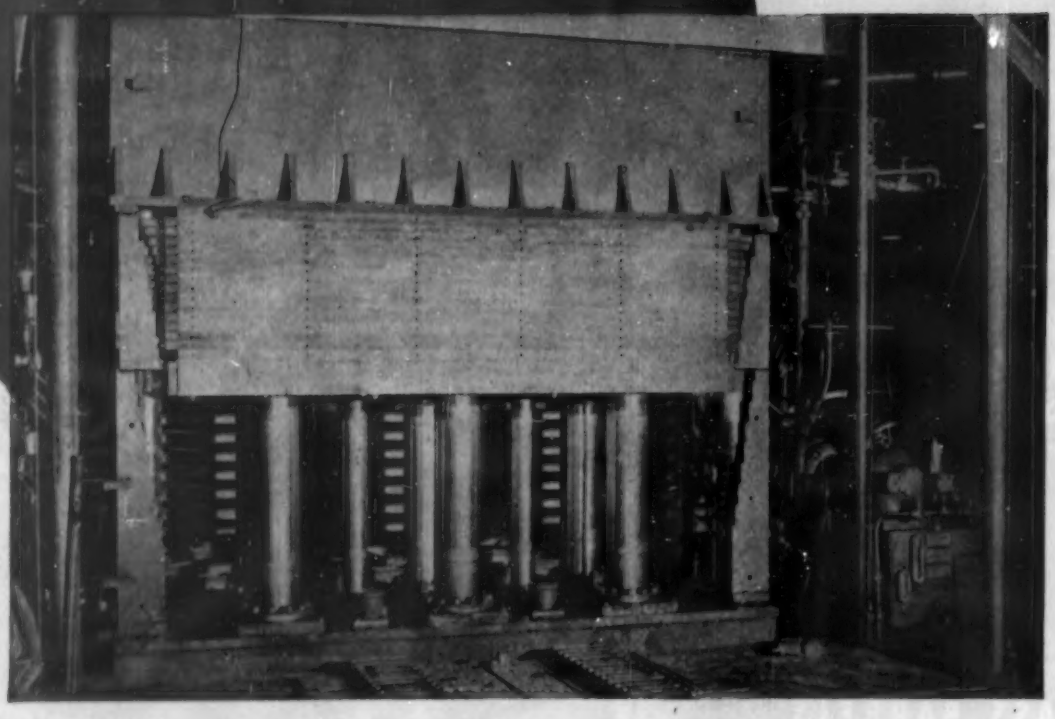
Miller

MILLER FLUID POWER CO.
(Formerly MILLER MOTOR COMPANY)

2008 N. Hawthorne Ave. Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

HOW TO STOP SLUDGE, RUST AND FOAM



THE BEST WAY . . . to protect hydraulic systems from sludge, rust and foam is to use the lubricant especially designed for that purpose — *Texaco Regal Oil R&O*. Then, you can count on noticeably cleaner systems . . . improved efficiency . . . extended pump and parts life . . . reduced maintenance costs.

Tests prove that *Texaco Regal Oil R&O* has *more than ten times the oxidation resistance* of ordinary turbine-quality oils — amazing ability to stop sludge, prevent rust and eliminate foaming. This means dependable performance, lower operating expense, no unscheduled shutdowns.

There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of all types and sizes of hydraulic mechanisms, and all operating conditions.

A Texaco Lubrication Engineer will gladly help you select the one to keep *your* equipment running smoothly. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL HYDRAULIC UNITS

TUNE IN: TEXACO STAR THEATER starring JIMMY DURANTE or DONALD O'CONNOR, on TV Sat. nights. METROPOLITAN OPERA radio broadcasts Sat. afternoons.

This control circuit for positioning the electrodes on an electric-arc furnace is the result of many years of development. Mechanical designs were replaced by hydraulic to give a device which has fewer working parts, less maintenance, lower energy consumption and faster action.

TWO PUMP METERING CIRCUIT

solves a costly control problem

● By C. W. Vokac

SUCCESSFUL operation of an electric-arc furnace largely depends on proper positioning of the heavy electrodes. Realizing hydraulic power is a "natural" for the controlled reciprocation of heavy masses, design engineers at the Whiting Corporation worked out the hydraulic system shown in Figure 1. This system has replaced the old mechanical positioning arrangements, Figures 2 and 3, and is an improvement over an earlier hydraulic circuit, Figure 4.

The new control circuit is extremely simple and efficient. Hydraulic components include an air-over-oil tank, two small pumps, a relief and check valve cluster and the power cylinder. The air-over-oil tank acts as an oil reservoir and also as a counterbalance system for the minimum weight acting on the power cylinder. Operation is entirely automatic. Arranged as a servo system, operation of the pumps is responsive to changes in energy at the arc.

Here is how the new control works: Referring to Figure 1, motor M_2 is connected directly to pump P_2 which pumps liquid from the tank T at a constant rate to the cylinder C_c. Motor M_1 is connected directly

THE ELECTRIC-ARC FURNACE is used almost exclusively in the production of steel castings and in steel plants for tool steels and other alloy steels. It is also being used in many steel plants to produce ordinary carbon steels, and in smelting plants and foundries for the smelting of ores and the production of castings.

C. W. VOKAC, *Manager, Whiting Corporation, Hydro-Arc Department, Harvey, Illinois.*

to pump P_1 and it pumps the liquid away from the cylinder C_2, returning it to the tank T. When the motors are running at the same speed, pump P_1 returns all the output of pump P_2 and the electrode does not move.

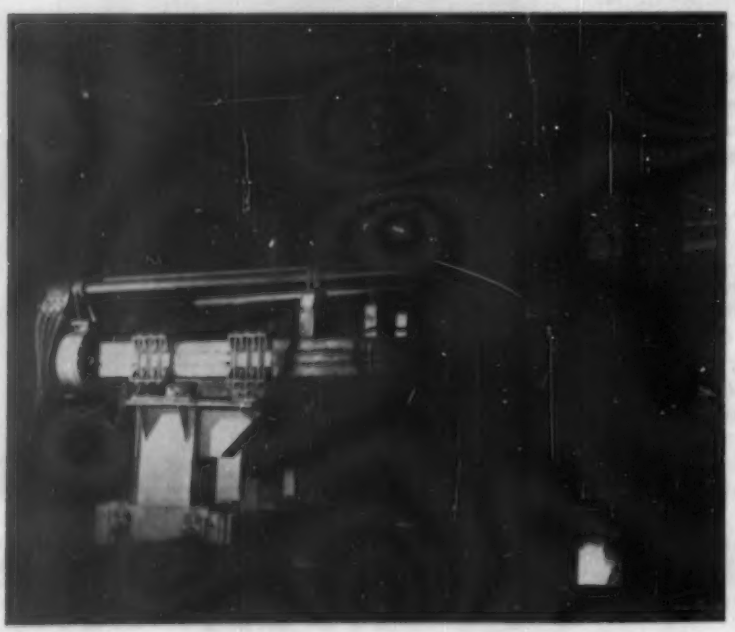
When motor M_1 slows down or speeds up, the difference in the output of the pumps either raises or lowers the electrode. Now then, the motor M_1 speeds up or slows down according to the amount the arc is off balance. That is all there is to it.

Both pumps are metering pumps. Pump P_2, doing all the work, is running at constant speed. Pump P_1 acts only as a metering valve, since the pressure across its ports is balanced. It changes speed only in proportion to the arc energy. Metering pumps give volumetric control for precise control of the electrode travel. They do not have valve lands to result in lost motion or loss of control, and do not have the usual port registration difficulties encountered with some valves.

An analysis of Figure 1 will show how the control reacts upon start of operations. All three electrodes, in a three-phase furnace, are set just above but not in contact with the scrap or burden to be melted or heated in the furnace. The control is started and the electrodes are energized. Motor M_1 draws full voltage and energy from the bus and runs at twice the speed of motor M_2. The electrode lowers at full speed until it makes contact with the burden. Either of two things or both happen at this instant depending upon whether the contact is mechanical or electrical or both.

If the burden is corroded or covered with nonconducting material, such as rust, scale, dirt, etc., as in most scrap, only a mechanical contact will be made and motor M_1 will continue to try lowering the electrode. But, as soon as the electrode makes a mechanical contact with the burden, a part of its weight is shifted off the cylinder and the pressure drops in the cylinder. But, check valve V_4 prevents the pressure in the cylinder from dropping below the air-counterbalancing pressure in the tank. Thus, this valve prevents an undesirable shift of weight off the cylinder to the electrode. The electrode, made of graphite, or carbon, is quite brittle and cannot safely support the weight of itself, the electrode arm and clamp, heavy copper bus and cable. Valve V_4 permits pump P_1 to run indefinitely at top speed or until the mechanical contact also becomes an electrical contact. Usually, this happens without special attention, even with exceptionally dirty scrap, especially when electrode voltages are high enough.

When the electrode makes an electrical contact with the burden, the voltage and energy to motor M_1 is shorted through the electrode and motor M_1 slows down. Since motor M_2 is running continuously, the electrode goes up as soon as the speed of motor M_1 passes the speed of motor M_2. If neither of the other two electrodes made contact with the burden yet, no arc current will flow. So, this electrode will continue to raise until contact with the burden is just broken. Then the electrode will again lower as before and rise again, continuing the cycle until another electrode makes contact with the burden. (Each electrode has its own independent control.) At that instant, current will flow through those electrodes. Since the electrodes played lightly on the burden, arcs are instantaneously formed. This prevents the usual, heavy, short-circuit current flow encountered with the mechanical furnace controls. Motor M_1 will get energy proportional to the



PRACTICALLY ANYTHING that comes from the earth can be melted or vaporized under the heat of the electric-arc furnace. The business end of this furnace has a negative characteristic, a tendency to destroy itself, which makes it especially difficult to control.

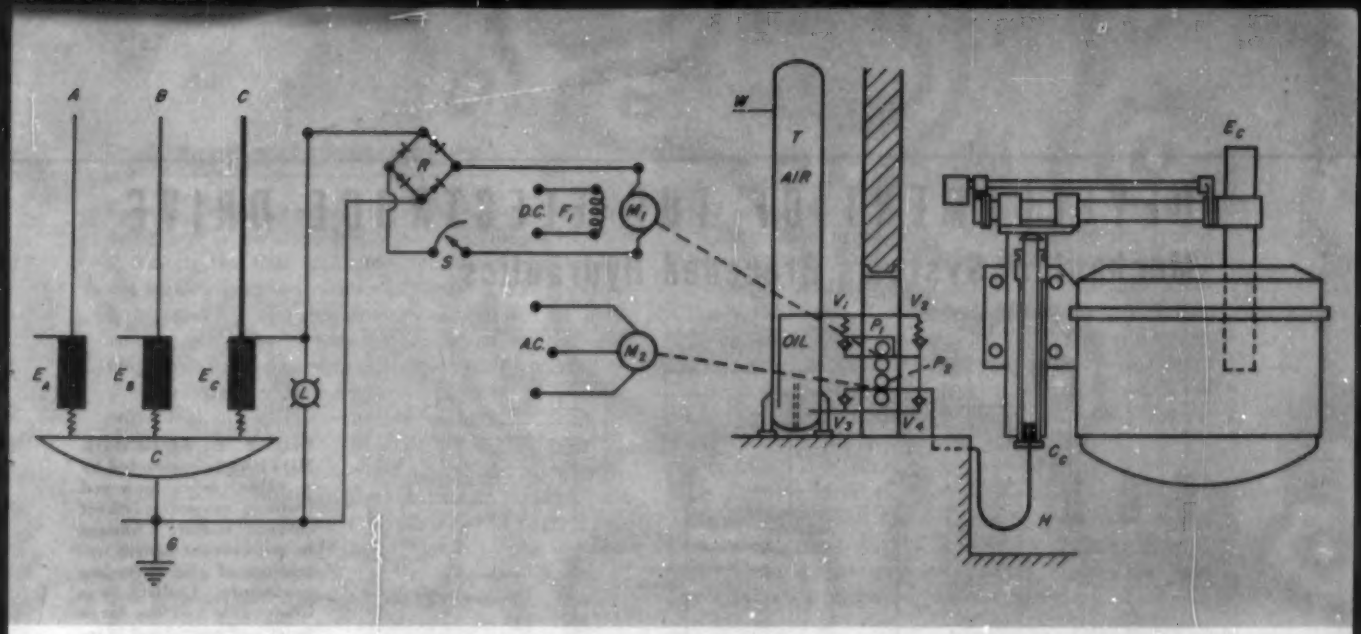


FIG. 1. THIS AIR COUNTERBALANCED hydraulic differential system controls the position of the electrodes to obtain the proper heat in the furnace. Small changes in motor current or torque result in proportional changes in the speed of the D.C. motor which controls electrode speed by changing the delivery of pump P_1.

energy of the arc. It will speed up, slowing down the upward travel of the electrode until the maximum arc energy is reached (or some predetermined maximum is reached) when the output of pump P_1 equals the output of pump P_2 and the electrode holds its position at the proper arc length.

RAPID RESPONSE TO CHANGE POSITION

Any change of conditions, such as the electrode burning away, the burden melting down, or the main line voltage fluctuating, etc. will cause the control to make correction within 1/20 of a second. None of the previous arc furnace controls even approach the response and speed of this air-counterbalanced, hydraulic differential.

Valve V_2 acts as any other relief valve in an hydraulic system. It relieves the pressure in the cylinder when the electrode reaches the top of its stroke. It also prevents undo pressure that would break an electrode, if it became fouled by cave-ins of the burden, etc. Electrodes usually free themselves without special attention, when this happens. But when this happens with mechanical controls, the electrode breaks, or the cable parts, or a pin shears, or the motor stalls before the electrode clears itself, resulting in a serious shutdown.

The air-counterbalance pressure, in tank T, is set to counterbalance the minimum weight on the cylinder C_c. Electrodes are consumed and new lengths are screwed on to extend them. Thus, the weight on the cylinder creates a greater pressure than the air-counterbalancing pressure almost at all times. The pumps have some slip even when new and more as they wear. When either one, or both pumps, are stopped, the fluid would leak from the cylinder to the tank and the electrode would drift down slowly. Valves V_1 and V_3 prevent this.

The hydraulic system is uni-directional. The pumps get a fresh, cool supply of fluid at all times. The entire system is totally enclosed. Packing glands are double sealed and vented. The cylinders are free at both ends preventing transfer of any moments, to strain the glands laterally.

The new control means: fewer working parts; less maintenance; lower electrode consumption; less circuit reactance; higher power factor and load factor; reduced energy consumption; greatly simplified circuits; uni-directional motors; faster action; faster melting, heating and smelting; true regulation in proportion to arc off-balance; longer refractory life; arc regulation over a wider range; instantaneous response; smooth arcs that flash downward; lower losses; reduced line surging; and solid, dead short circuits eliminated.

Of course, this new design, with all its inherent advantages was preceded by many different positioning systems.

Early in this century, electric-arc furnaces were manually operated, that is, the arc-gap between the electrode and the burden in the furnace was regulated manually by a mechanical jack or hoist that raised or lowered the electrode. Such a crude arrangement, being too slow to respond to rapidly changing conditions which would permit the arc to extinguish itself, required loading down the arc current circuit with reactance so that the circuit characteristic became overwhelmingly positive to offset the negative arc characteristic. That circuit reactance was a production deterrent, but the emphasis, at that time, was not

DEVELOPMENT OF THE ELECTRODE DRIVE

Mechanical Systems Preceded Hydraulics

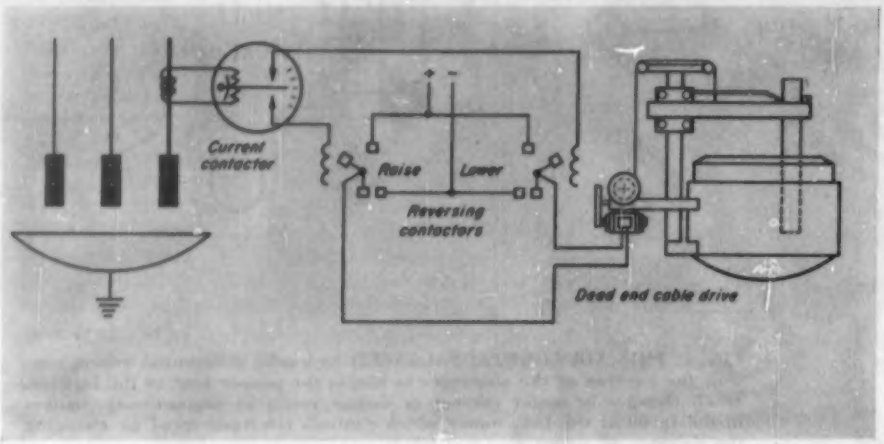


FIG. 2. ELECTRODE MOTION is controlled by a cable drive powered from a reversing direct current motor. Changes in arc current causes operation of the reversing contactors. Control was inadequate and the large hoist had considerable inertia.

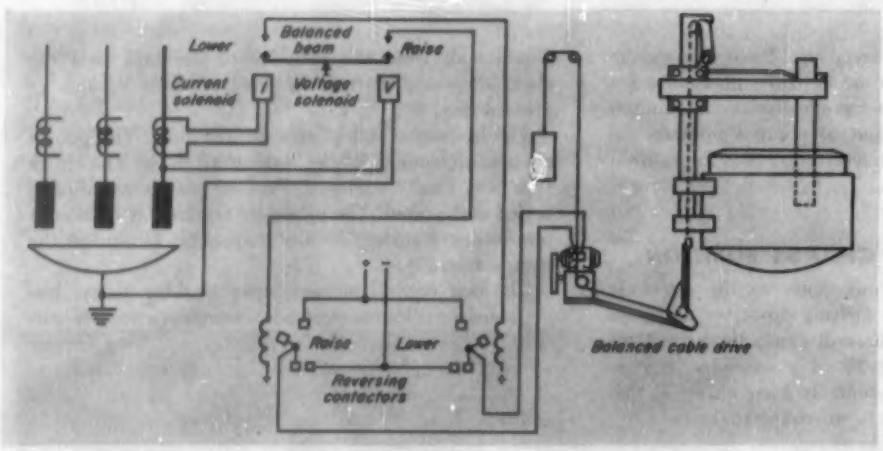


FIG. 3. ADDITION of a counterweight balances the weight of the electrode and its moving parts. Overall inertia was reduced and the hoist motor was moved away from the heat and dust of the furnace. This motor control still resulted in considerable over-travel and hunting.

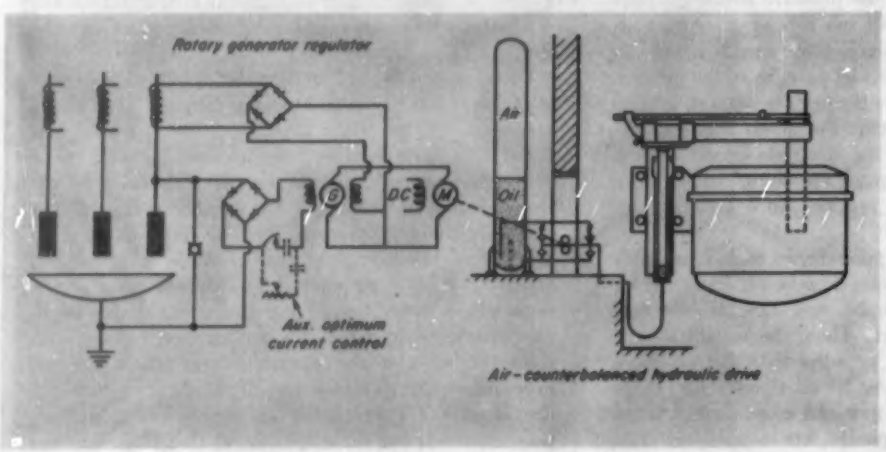


FIG. 4. Air under pressure in the accumulator counter-balances the electrode, and hydraulic power does the electrode positioning. With this arrangement, the motor driving the hydraulic pump must be constantly reversing. To eliminate this inefficient motor action, the new circuit was developed as shown in Figure 1.

upon production; the arc furnace was used to do what could not be accomplished with other means.

Among the first automatic controls applied to the arc furnace is the one shown in Figure 2. The electrode hoist, a dead-end cable drive, was operated by a reversing, direct-current motor, energized by reversing contactors. The reversing contactors were operated by a contact-making ammeter which responds to the arc current changes. The ammeter was set for a predetermined arc current. When the arc current was too high or too low, the electrode was raised or lowered. Current alone, however, does not mean BTU's in the furnace. It requires the proper product of current and voltage. The hoist and hoist motor was necessarily large with considerable inertia. The inefficiency of this arrangement was soon realized and development lead to the improved arrangement shown in Figure 3.

A counterweight was used here to counterbalance the weight of the electrode and its moving parts. This reduced the size of the motor and speed reduction unit and considerably reduced the overall inertia of the system to provide a better response and faster correction of the electrode position. This arrangement permitted also the removal of the motor and reduction unit off the furnace, out of the heat and dust, and away from the magnetic field of the secondary circuit. The same reversing contactors energized the motor but the contactors were operated by a balanced-beam type of relay that responded to arc current and arc voltage. But, like the previous control, this one responded to only arc off-balance and not to the degree of arc off-balance. The electrodes were raised or lowered at full speed when correction was required, even when the amount of correction needed was small. The result was considerable overtravelling and hunting. Maintenance of points and arcing contactors was still a problem here; limit switches were only partially eliminated; increased cable lengths and added sheaves increased the friction; inherent lost motion was even more pronounced here; the counterweight added inertia to the reversing system; and foundation and installation costs were considerably increased.

FIRST HYDRAULIC DESIGN

Further development work was obviously necessary. This led to the application of hydraulics to solve the many problems encountered with the mechanical equipment. A differential field, rotary generator was used to overcome some of the electrical problems. This arrangement is shown in Figure 4.

Here, air under pressure in an accumulator is used to counterbalance the weight of the electrode and its moving parts. Since the air is relatively weightless and hardly moves, it introduced practically no additional inertia or friction to the system. The hydraulic fluid transmits motion with very little friction compared to cables and sheaves. Speed reduction is affected statically, by simply varying piston diameters, with little loss, as compared to the loss of dynamic speed reducers, with double worms, etc. Hydraulic fluid is practically incompressible and results in almost no lost motion as compared to that of stretchable cables and worm gears.

The inertia, friction and lost motion of the system being reduced, a smaller motor (also with less inertia) moves the electrode faster and positions it more accurately. The motor, connected directly to a metering pump, is energized by the differential field generator. The fields are arranged to oppose each other. One is energized by the arc voltage and the other by the arc current. The resultant field, being proportional to the arc off-balance, has a tendency to permit the generator to produce a proportional voltage to make the motor run at a proportional speed according to the arc off-balance. Maintenance of points and arcing contacts is eliminated. The valve cluster arrangement eliminated all limit switches, since it provides complete protection of all the equipment for every increment of the electrode travel and in both directions, up and down. Foundation and installation costs were reduced. The motor and control is located in the control room, not on the furnace.

COMPLICATED ELECTRICAL CONTROLS

Though this is a long way from the first automatic control used for electric-arc furnaces, it is still not completely satisfactory for the purpose. About 5 to 10 amperes of current is drawn from current transformers on the electrode bus and another equal amount is drawn directly from the bus directly. Most of this is dissipated to apply a relatively feeble difference to the differential field generator. More power is used to drive the generator so that it will produce the necessary few amperes that the motor needs to move the electrode.

If the signal from the furnace bus were a feeble one that required amplification to drive the motor, then there would be a justification for the use of the special differential field rotary generator. But, there is more power in the furnace bus than is required for the largest motor necessary to move the largest electrode. Obviously, there is no need for this extra machinery, the extra circuit complications it introduces, the extra maintenance, the reduction of response range, and the extra time lag it introduces to reduce the speed and response of the control.

When the furnace is in "business", the electrode is constantly moving up and down. The motor is, therefore, constantly reversing and trying to do a job from standstill position. The high starting currents, required to develop high starting torques, heat up the motors, especially when these high currents are constantly changing from plus to minus as when the furnace is "in business". A motor can develop its full rated power only when running at full rated r.p.m. It can do its job efficiently and keep cool only at or near full rated r.p.m.

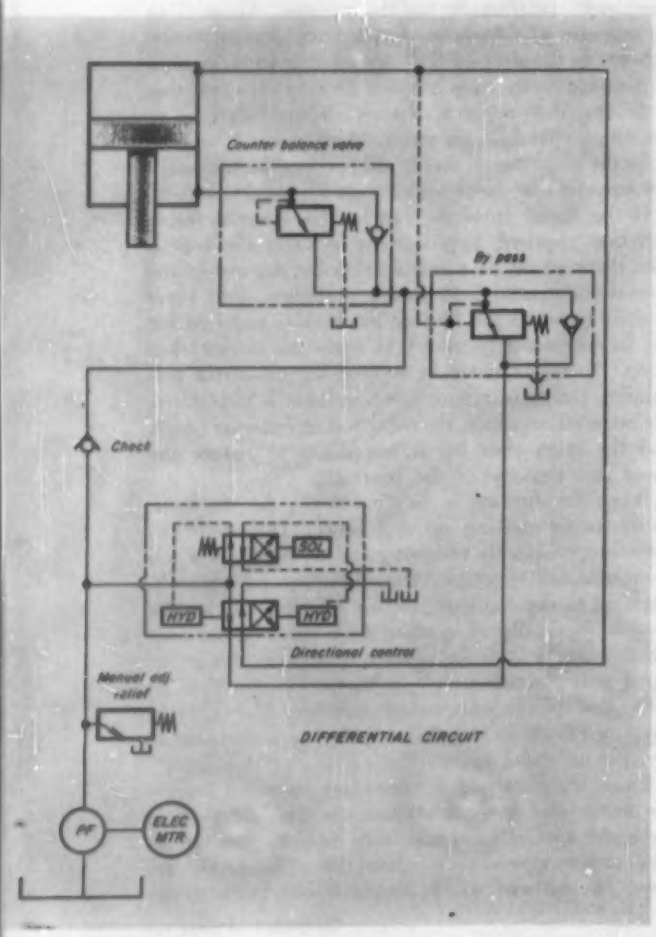
Since high starting currents are required to get the motor and its load started, the fine differentials from the special generator only heat up the motor. The motor moves only when the differentials are great enough and so the result is only little better

Concluded on page 107

NEW *Fluid Powered* MACHINES

Design of hydraulic straightening press assures . . .

ACCESSIBILITY FOR MAINTENANCE



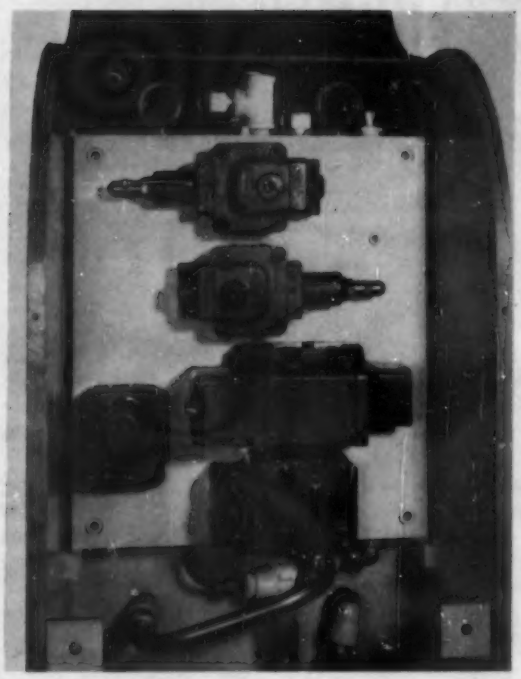
GOOD mechanical layout of parts and an efficient differential type circuit are found in the new line of straightening and forcing presses built by Stanley H. Holmes Co., Chicago. Use of "O" ring gasket mounted valves on a drilled manifold plate eliminates the need for conventional pipes. With oil flow carried through the drilled manifold plate, there is no possibility of between port leakage.

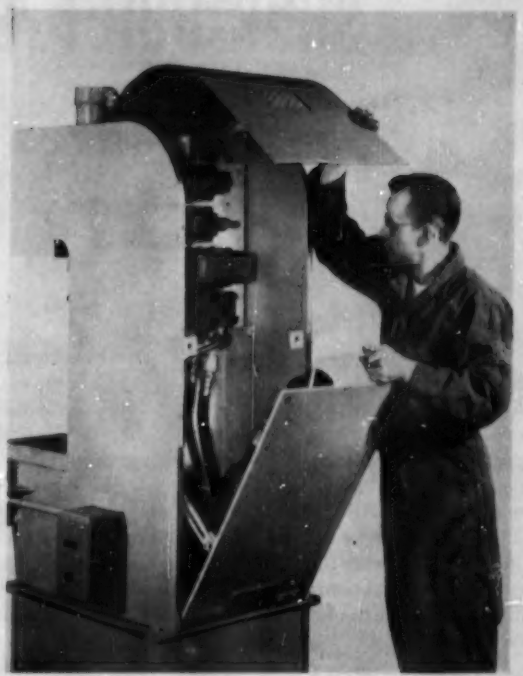
There are only four piped connections to the manifold—one from the pump, a tank return line and the two lines to the press ram. Four bolts hold the manifold on the press frame. This arrangement makes it extremely easy and fast to remove and replace the entire hydraulic valve system. This feature reduces downtime to a minimum.

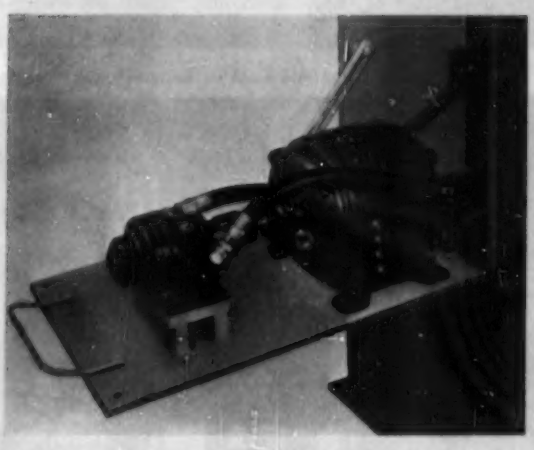
Accessibility to the pump and electric drive motor is provided by a swing-out panel on which the pump and motor are mounted. Removal of two bolts permits the hinged panel to be lowered to a convenient horizontal position.

To provide maximum closing speed for the press, a differential circuit was arranged. This circuit differs from the standard differential circuit because it is arranged to automatically cut-out the differential action when the ram has contacted the work. In the standard differential circuit, pump pressure is applied on both the rod and blank end of the ram. Increased speed is obtained because the flow of oil to the blank end is

USE OF A BYPASS VALVE changes the operation of this circuit from fast differential action during closing, to high pressure conventional action when the ram contacts the work. Maximum working force limited by the relief valve setting can be applied to the press ram.







Neatness in valve layout and piping of a hydraulic system is a good indication that the oil circuit is designed for maximum reliability. Grouping of panel mounted valves provides compactness, maximum rigidity and accessibility for adjustment.

equal to pump delivery *plus* oil coming from the rod end. This increased speed is obtained at the expense of reduced tonnage because the effective downward force is equal to pump pressure times the area of the blank end *minus* pump pressures times the annular area of the rod end. When a press ram has made contact with the work, remaining travel is small. At this point, the advantage of increased speed given by a differential circuit is no longer needed and maximum force is desired. On the Holmes press circuit, use of a bypass valve changes the circuit from a differential action to conventional action when the ram contacts the work.

Tracing through the circuit shows how this control system operates. With the ram up and the work located on the press table, pushbutton operation energizes the single solenoid, pilot operated, two position 4-way valve. The control valve shifts to direct oil pressure to the blank end of the ram. Pressure now builds up to the setting of the counterbalance valve and oil from the rod end joins the pump flow to the blank end. The press rapidly closes. When the work is contacted, pressure builds up and the pressure operated bypass valve opens to relieve the pressure on the rod end. The rod end is now open to tank, and maximum working force, limited by the relief valve setting, can now be applied to the press ram. When the press operation is completed, deenergizing the solenoid valve causes the press to open. The counterbalance valve prevents ram movement due to gravity when the press is open.

This line of presses includes models developing 5 to 150 tons having a stroke of 10 to 30 inches. Constant displacement pumps are used. An oil level sight gage and a pressure gage mounted on the front of the press give visible indication of circuit conditions. Manual or electrical controls are provided.

SHOP-BUILT BOX FORMER

saves $12,000 a year

USE of an air powered cardboard box forming press at Temco Aircraft Corporation, Dallas, helps reduce the annual cost of shipping containers by $12,000 to $15,000. Because Temco found it expensive to stock cardboard shipping cartons for its hundreds of varied and changing products, their production engineers set about to obtain the necessary machines for making their own boxes.

Three major pieces of equipment are used. Two of them—a 36 inch bandsaw and a portable stapling machine—are conventional, marketed items. The third is a layout and bending device which had to be shop-built.

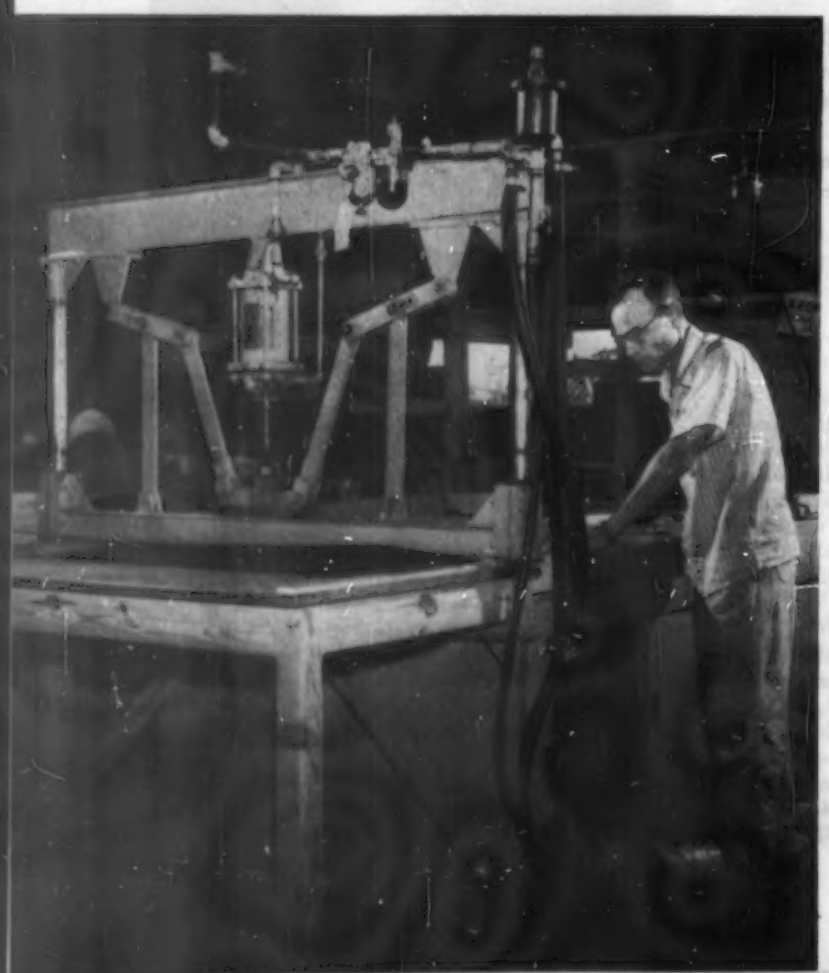
The box former resembles a press brake and performs much the same function. Framework for the device is made of channel steel and stands six feet high. A 5 inch bore, 5 inch stroke air cylinder, operated by a foot operated 4-way valve actuates the brake blade.

Blade and cylinder are connected by a linkage arrangement with toggle action. This linkage serves two purposes: it doubles the pressure delivered to the blade, and it distributes pressure evenly along the 5 foot length of the blade.

The blade assembly is similar to the top die on a power brake. It consists of two 5 foot lengths of channel, back-to-back, with a flat length of 3/16 x 2 inch rolled steel sandwiched between them.

Carton making at Temco is normally a one man operation. The operator begins by jotting down the required carton dimensions and then selecting the right size sheet of corrugated cardboard. He places the cardboard on the table, alongside the rule, and lays out the bend lines with the press brake. The brake indents the cardboard sufficiently to break down the corrugation, but not enough to damage the waterproofing.

The operator cuts the carton corners on his bandsaw, then folds and staples the box with the automatic stapler. He can turn out up to 150 boxes a day, each one a different size. Or if carton size is standard, a day's production rate goes up to 250 or more. Output could be doubled if necessary, by putting one man on each of the three steps in the operation.



SHOP AIR supplied to the 5 inch bore cylinder powers the brake blade. Toggle action doubles the force developed by the air cylinder and distributes the pressure evenly along the 5 foot length of the blade.

A SPECIAL trolley carrier was designed to load and unload the conductor bars into and from the machine. Here one of the large bars required for generators is being moved from the machine.

Complicated Bar Bending with HYDRAULIC POWER

A COIL spreading and forming machine, capable of receiving electrical conductor bars up to 15 feet loop length and performing four distinct operations—spreading, twisting, bumping and final setting—automatically in one setting of the machine, has just been put into operation in the coil shop at the Allis-Chalmers Manufacturing Co., Milwaukee, Wis. The four basic operations are performed hydraulically, a fifth operation, clamping the bar into the machine, is done by an air circuit.

The new machine is flexible. In addition to very large and heavy conductor bars (up to one inch wide and 4 inches deep), it can accept a wide range of sizes, both of standard and special size bars. The machine can be changed from one size to another size bar in a relatively short time. The coil spreader and former has been designed so that settings for a very wide range of movements, both linear and rotary, can be obtained easily and to tool room accuracy.

BAR BENDING MACHINE

The four basic operations of spreading and forming conductor bars are performed by 4-way valves in a single circuit—three of the operations—spreading, twisting and bumping being powered by cylinders and controlled in automatic sequence by four push button switches; the fourth operation, setting, is performed by a fluid motor, controlled by a separate switch.

Originally, conductor bars were spread and formed manually on wooden jigs. This required the construction and stocking of a jig for every size bar. As the conductor bars had to be successively spread, twisted at the "U" bend, "bumped" and the final angle set so that the completed bar would fit into the mating slots in the generator stators, the operations were slow and tied up two specially trained men.

Then motors and generators got bigger and bigger. Building them was often a special design job and a very costly layout and tooling job. There was a real problem, the problem of making equipment that would be flexible, versatile and, if possible, as fast as equipment that had been developed to make small, high production units. This was a big order.

About five years ago the first machine was designed and built to perform a number of the conductor bar operations with one setting of the machine. In spite of the fact that the first spreader and former was designed with anticipated, future requirements in mind, it was not long before the machine had to be strengthened to take care of larger and heavier conductor bars.

When the planning for the new spreading and forming machine was done and its design developed, the experience with the first machine and a study of the trend toward even larger generators led the Tool Engineering Department to think in terms of an exceptionally sturdy machine of greater capacity and flexibility than ever built for similar operations. To all intents and purposes, the new spreading and forming machine was built to tool room accuracy and heavy, continuous duty specifications.

A REAR VIEW of one wing of the machine, showing the vertically mounted bump cylinder (with hose connections), one of the two air operated clamping heads (top), supply tubing and one of the feed valves. Hose is required for both the main frame and adjustable wing movements.

HYDRAULIC CIRCUIT

A hydraulic power package with a double end motor drives two variable volume 1500 psi pumps. The 120 gallon reservoir is mounted behind the motor-pump units; the four major four-way valves for operating the four movements—rail motor j, spread K, bump g and twist H are mounted in a row along side the reservoir above the base frame of the machine, con-

THE NEW coil spreading and forming machine at Allis-Chalmers is being put through a test cycle by Joe Hauk, designer.

A VIEW from the operator's position, looking down at the centrally located fluid motor which is used for raising and lowering the main frame to put a set in the coil, also for rapid traverse in loading.

venient for adjustment or servicing.

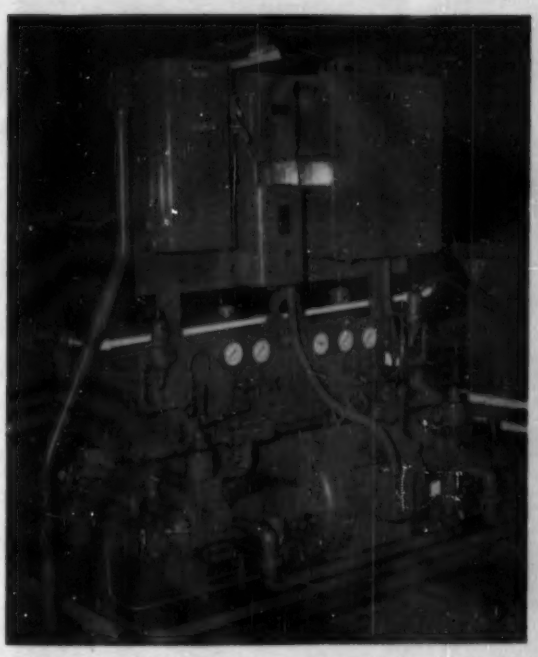
With settings made for a specific size bar to be spread and formed, the motor and pumps are started. The conductor bar is loaded into position by means of an overhead trolley crane and clamped by means of air cylinders, two on each side of the machine. Separate, manually operated levers are provided for each of the four air valves, each of which operates a clamping cylinder.

The four push button switches energize the spread valve K, twist valve H, and bump valve G in turn. All these valves are double solenoid, two position 4-way valves. The spread valve supplies pressure fluid to the 8 inch horizontal cylinder which opens the sides of the conductor bar loop; the twist valve supplies fluid to four 2 inch cylinders (two on each side of the machine) which, when their pistons extend, turn or twist the loop ends; the bump valve supplies pressure fluid to two vertically mounted 4 inch cylinders on the wings of the machine. The cylinder pistons rise against the loop, "bumping" or bending the loop. The fourth push button switch deenergizes the spread, twist and bump valves, returning all cylinders to their starting positions.

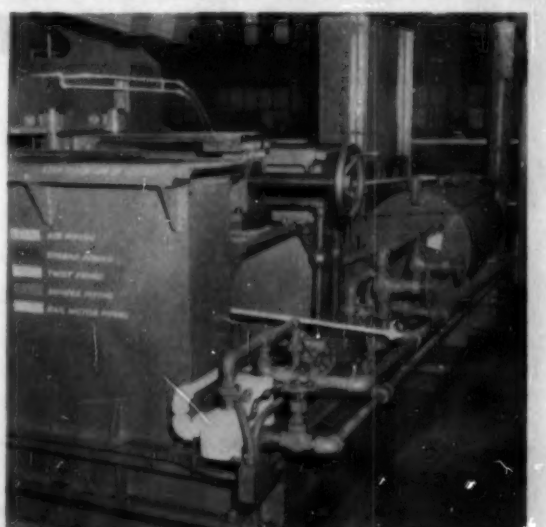
A separate switch then energizes the rail setting J valve. This is a spring centered, double solenoid 4-way valve. When energized it operates the fluid motor which puts the set in the side rail of the bar. This imparts the final angle to the long sides of the bar, assuring final fitting of the bar into the mating slots in the generator stators.

Before starting, the operating limits of the machine are set. The spread setting is adjusted by handwheel and screw at the rear of the machine (this controls the amount of spread of the bar); the side wings are set for the loop length of the bar to be processed; the twisting setting is made for angle between the sides; and the rail setting is made for amount of elevation and lowering of main frame (for set in bar sides).

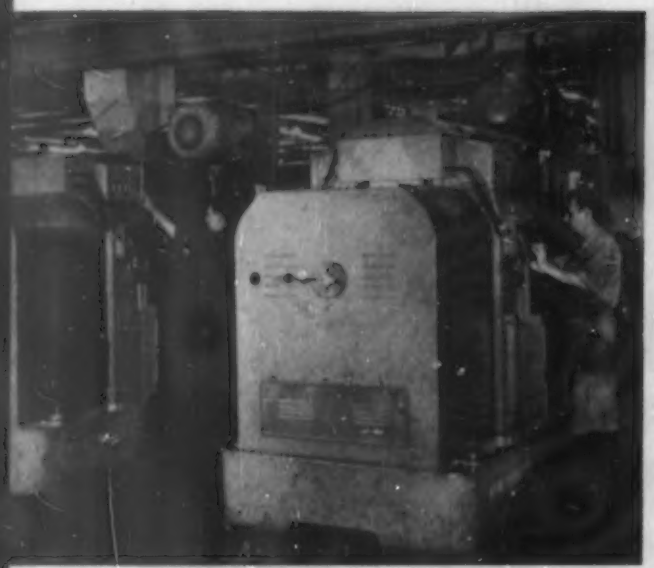
The machine was designed around the flexibility which the hydraulic circuit supplied. Easy to operate and well within the scope of routine maintenance skills, the hydraulically operated spreading and forming machine can anticipate a long operating life.



THE HYDRAULIC package power unit has a double end motor driving two variable volume vane pumps. One pump supplies the twist (H) and bump (G) valves; the other the spread (K) and rail (fluid motor) (J) valves.



VALVE ASSEMBLY at rear of machine, showing row of double solenoid operated, 4-way valves, left to right, rail motor, spread, bump and twist. All except bump valve are provided with wheel type throttle valves. The elevated circular reservoir and electrical panel are shown at right. A color code for each operating branch of the circuit helps simplify and speed maintenance and service.



Here is an analysis of the operation and selection of the hydraulic and electrical circuits on a standard machine tool. Comparison is drawn between earlier use of pilot operated circuits and new electrically controlled circuits.

HYDRAULIC AND ELECTRIC CIRCUITRY

for Machine Tools

● By H. W. Brown and J. H. Smith

DESIGNERS of electrical and hydraulic circuits for all types of machine tools are confronted with similar problems involving speeds, forces, accuracy, timing, safety and layout. The ultimate goal of a machine designer is to create a reliable competitively priced machine tool which will do the desired job during a safe, fast cycle. Therefore, before any circuitry is selected, the requirements of the job must be known. Knowing what work must be done in a given time, the designer is then able to select the machine functions which are to be powered hydraulically.

In recent years, hydraulic circuits on machine tools have gone through several changes which were mainly brought about by the availability of new types of hydraulic valves, pumps, and other circuit components. Also new techniques in circuit layout have resulted in need for redesigning of many existing machines.

Typical of control system redesign on a machine tool is the new circuitry on the chucking machines built by The National Acme Company. Figure 2 is a photograph of the older hydraulic layout which used pilot cam and manual operated valves. Hydraulics was used to perform only two functions—holding the work and start-stop control of the spindle. Figure 1 shows the new circuit which uses panel mounted electrically actuated valves. Piping has been simplified and the use of a valve manifold gives greater reliability to the system. The use of an electrically controlled hydraulic system permits faster cycling, reliable repeatability and greater flexibility. More hydraulically powered functions have been added. Along with holding the work and starting and stopping the spindle, tool feed is engaged and disengaged, and power reverse is provided.

H. W. BROWN, *Research and Development Engineer,* J. H. SMITH, *Machine Designer, The National Acme Company, Cleveland, Ohio*

Here is how the system functions:

A. Depressing hydraulic motor start button (PBS-3) starts the hydraulic pump motor. When the desired chucking pressure is reached, the N.O. contacts in the pressure switch close, preparing a circuit for starting the main motor.

B. Depressing the main motor start button (PBS-1 or PBS-2) starts the main motor.

C. Operator now actuates the manual control lever (CH-1) to the "unchuck" position and loads the piece. Moving this manual lever closes the N.O. contacts of relay (CR-4) and, in turn, energizes the solenoid in valve (7) allowing pressure to "port B". Through main distributor (10) this pressure is directed to cylinder (11) and chuck opens.

D. Operator then actuates manual control lever (CH-1) to the "chuck" position and chuck closes. Movement of this lever de-energizes relay (CR-4) and the solenoid in valve (7) drops out. This solenoid-operated, 4-way valve is spring off-set; consequently, the pressure is directed to "port A" and cylinder (11) is again actuated, closing the chuck.

E. If this chucker is arranged for double indexing, as is the case with the 8 spindle chucker, a second chuck-opening lever (CH-2) will be actuated and operations C and D would be repeated.

F. Operator now actuates the spindle start and stop lever (SS) to the "start" position, and the stopped spindle (or both, if it is a double index machine), will start. When this lever is in the "start" position, it energizes a relay whose N.O. contacts are held closed by the holding coil of relay (CR-1). In turn, the solenoid in valve (9) is energized, opening pressure to "port B" which directs pressure to cylinder (13), causing the spindle to drive.

G. Operator depresses the "reset" button, preparing an electrical circuit for engaging the feed.

H. To engage the feed, the operator depresses the "feed on" button (PBS-4 or PBS-5). This energizes the holding coil of relay (CR-5), and the closing of the N.O. contacts energizes the solenoid in valve (15), opening pressure to "port B". Cylinder (18) is actuated and the feed clutch is engaged. Pressure from "port B" of valve (15) is also directed to cylinder (19), which, when actuated, will "knock off" the manual feed hand crank, thus preventing the operator from being struck by a rotating handle.

At the completion of the machining cycle, the machine will now index bringing into position the spindles for unloading and loading. Indexing of the machine actuates limit switch (LS-2) and the spindles which are in the loading position will automatically stop. Stopping of the loading spindles also actuates limit switch (LS-1) and prepares a circuit for chucking. Actuation of limit switch (LS-2) opens a circuit and the holding coil of relay (CR-1) drops out, de-energizing the solenoid in valve (9). Valve (9) is another solenoid-operated, spring-offset, 4-way valve and opens the pressure to "port A" allowing pressure to cylinder (13), stopping the spindle.

An additional feature incorporated in the present machines is automatic feed "knock-out" just prior to the return of the toolslide. This is accomplished by the actuation of limit switch (LS-4) which will drop out the holding coil of relay (CR-5) and de-energize the solenoid in valve (15). This valve is spring off-set and will permit pressure to "port A" then on to cylinder (18), disengaging the feed clutch. Coupled within this same circuit, we utilize a reset button, (PBS-6) because normally the operator will have ample time to unload and load a part, and there is no need for automatically disengaging the feed clutch. To this end, the depressing of the "reset" button prepares a circuit that by-passes limit switch (LS-4) by means of the N.O. contacts of relay (CR-6). This then permits the

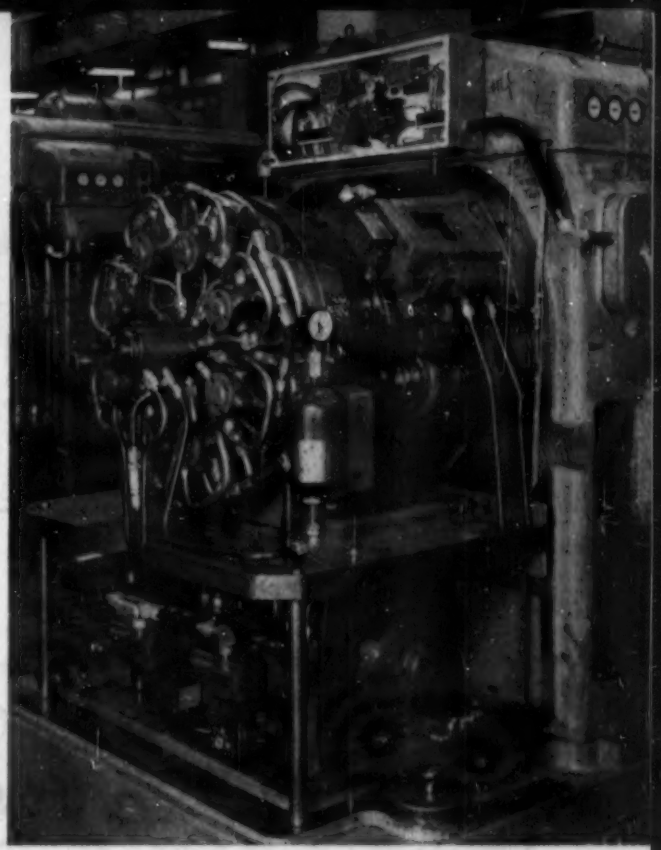


FIG. 1. NEW SYSTEM provides easier maintenance and greater rigidity by panel mounting the control valves. Control is now by electrical actuation. Use of a double pump increases efficiency of the system.

FIG. 2. OLD HYDRAULIC SYSTEM used pilot, cam and manually operated valves. Valves were not panel mounted. And only a single vane pump was used.

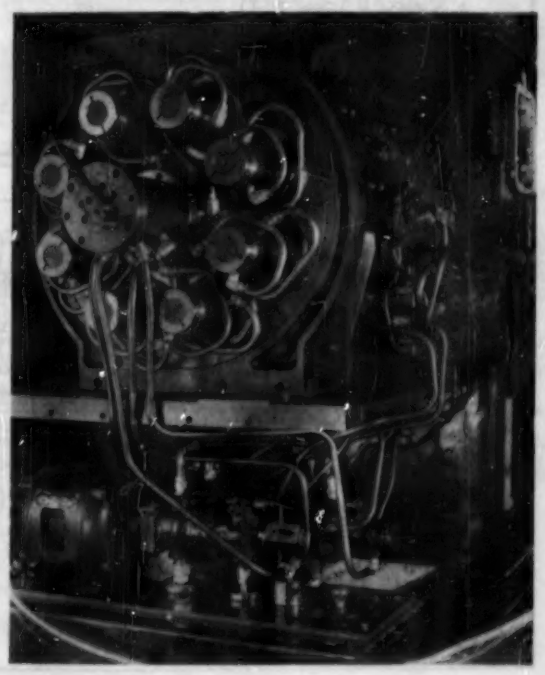


FIG. 3. HYDRAULIC CONTROL circuit for an eight spindle double indexing chucking machine. Hydraulic power is applied to hold the work, to start and stop the spindle, engage and disengage the feed and provide power reverse.

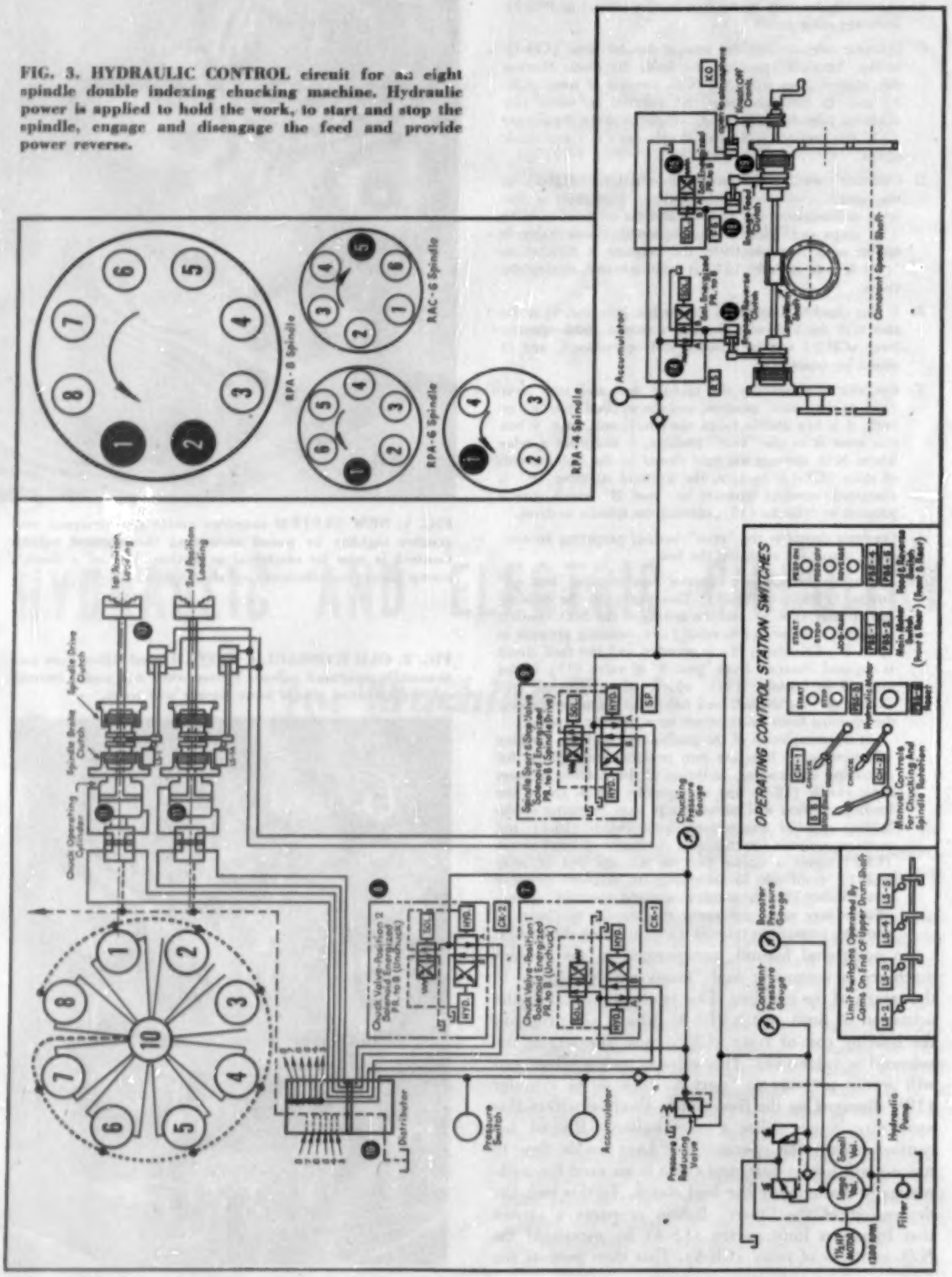


FIG. 4. ELECTRICAL CONTROL circuit for the eight spindle chucking machine. Safety interlocks prevent improper sequencing of operations.

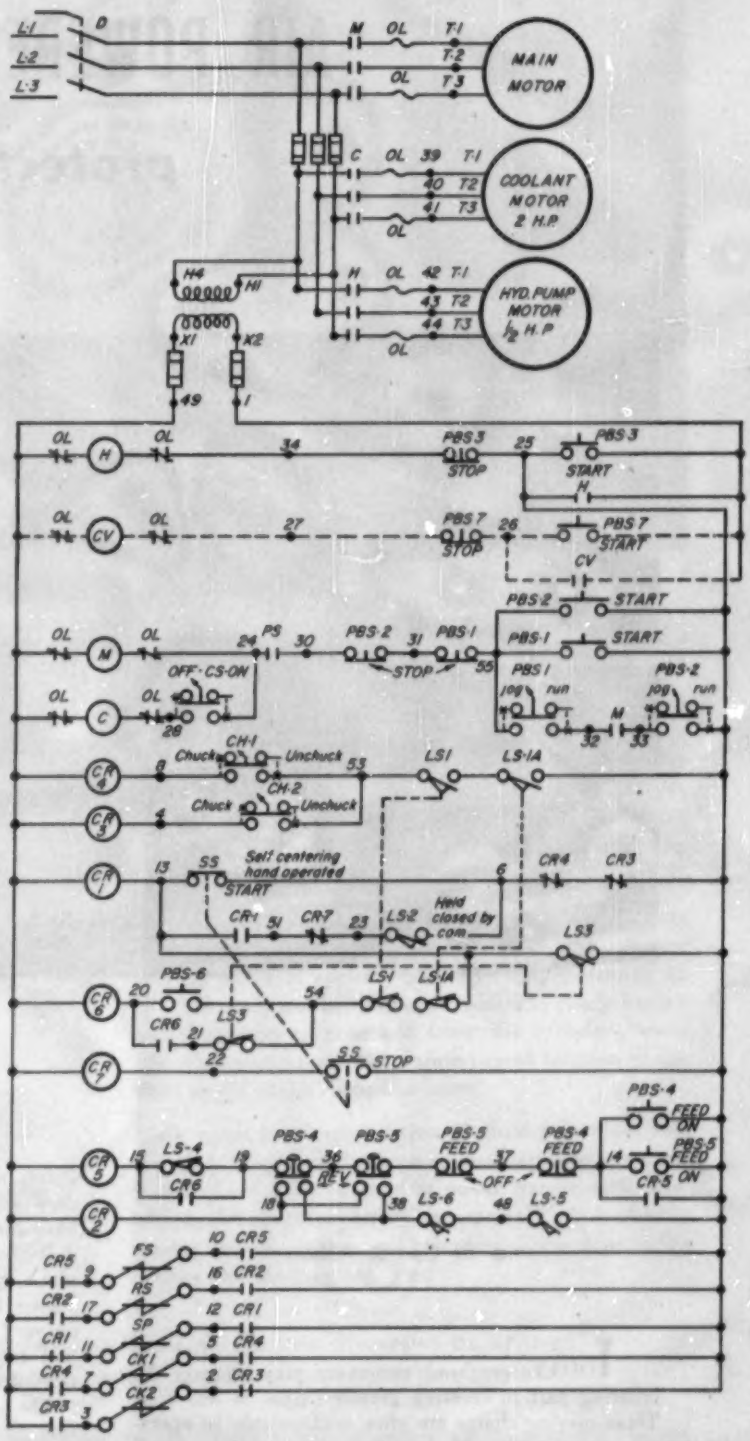
machine to operate continuously.

Another feature is the ability to reverse the main drum shaft, which permits the toolslide to be withdrawn during the machining cycle. Depressing the "reverse" button, when the feed is disengaged, energizes the holding coil in relay (CR-2) and the N.O. contacts energize the solenoid in valve (14). Pressure is then directed to "port B" allowing cylinder (17) and cylinder (19) to be actuated. The actuation of cylinder (17) engages the reverse clutch and the actuation of cylinder (19) will "knock off" the manual feed hand crank. Incorporated in this circuit, we have two limit switches (LS-5 and LS-6). Limit switch (LS-5) is cam actuated and timed, so that reversing can only take place during the machining cycle, while limit switch (LS-6) is added to insure that the feed is not or will not be engaged. If the functions of these limit switches are not met, reversing the machine is impossible.

COMPLEX PILOT OPERATION

In the earlier hydraulic circuits, even though we had only two functions to meet, the circuit was rather complex. From a vane type, constant delivery, single pump, we directed the output to a sequence valve permitting the free travel of the oil to a pressure reducing valve. The reduced, or chucking, pressure was then directed through another sequence valve, through a check valve, into our main hydraulic distributor directing the oil finally into the holding cylinder to maintain a constant chucking pressure. When the desired chucking pressure was reached, the sequence valve, prior to the check valve, permitted oil to flow to a pilot-operated, 4-way valve. The oil, upon reaching this valve, passed through "port A" or "port B" to the chucking and unchucking cylinder. Pilot operation of this valve was both internal and external. The external portion was operated by a 4-way, pilot valve.

Continued on page 106



AIR POWERED LUBE SYSTEM

protects conveyor lines

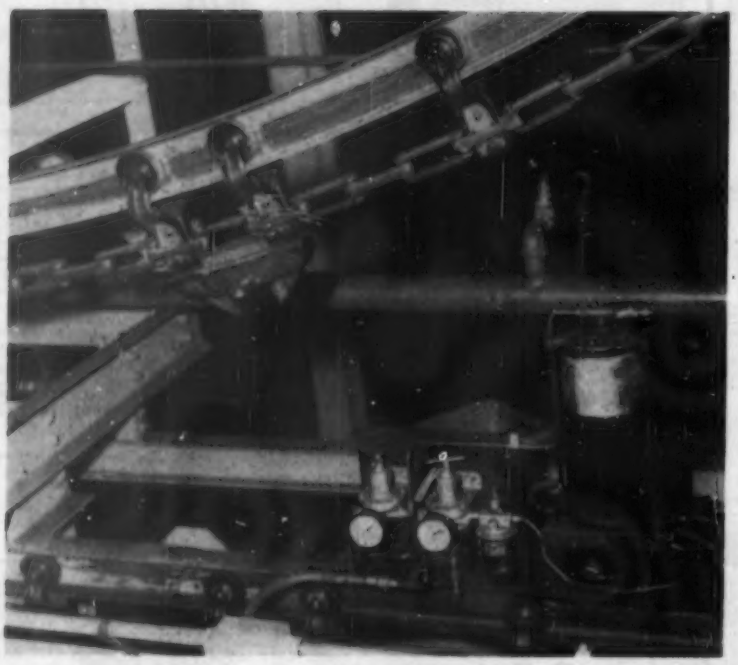


FIG. 1. RIGIDLY MOUNTED on the conveyor track, this lubricator will automatically supply oil to each wheel bearing as the wheel passes.

● By Carl S. Abbott

TODAY, overhead conveyors play an ever increasing part in creating greater output at less cost. These moving chains are often continuously in operation. Good methods for properly lubricating the bearing of these rotating wheels are an absolute necessity. In large plants, such as the Ford Cleveland Engine Plant, where there are miles of conveyors and hundreds of rolling wheels, automatic lubricating devices have proved invaluable.

With a compressed air supply available in every plant, the use of an air operated lubricating system, Figure 1 offers convenience and a design which takes up very little room, uses only small volumes of air, and requires only occasional care to provide uninterrupted hours of automatic lubrication.

The simple air circuit, Figure 3, controls the operation of the lubricator. The lubricator is a self-contained unit which is mounted on the conveyor trolley rail and actuated by the moving conveyor.

As a trolley wheel approaches the lubricator, the hub engages the nozzle of the pumping unit which

CARL S. ABBOTT *J. N. Fauver Co., Inc., Detroit, Michigan.*

Power Packed "Commercial" Hydraulic Pump Keeps Snow Fighters Moving

THIS HEAVY DUTY service "Commercial" double hydraulic pump will develop fluid power to flex the muscles of the fluid motors which operate the brush equipment mounted on this tractor. The entire mounting is as clean as the cleared road which is left.

Two separate pumps, assembled into a single unit, are driven by one through shaft to which the primary driving power is applied. Safe operating pressures up to 1500 p.s.i. can be developed with one pump having ample capacity to raise and lower the cylinders, while the other pump maintains uninterrupted rotation of the fluid motor which turns the brush.

Here again is an application of fluid power controls giving a simplified, lower cost installation when compared to any other method of power transmission. You will find that there are "Commercial" oil hydraulic pumps, motors, valves, and cylinders giving dependable service and working near you.

"COMMERCIAL"
"PRODUCTS PREFERRED BY CUSTOMER ACCEPTANCE"

THE COMMERCIAL SHEARING AND STAMPING COMPANY
YOUNGSTOWN 1, OHIO · CHICAGO, ILLINOIS · SALT LAKE CITY, UTAH

PUMPS · MOTORS · CYLINDERS · VALVES

RA-62

is then automatically brought into contact with the grease fitting. The trolley wheel carries the nozzle with it and when the nozzle is pointing straight at the trolley, an adjustable measured amount of lubricant is discharged under pressure into the wheel bearings. Point of lubricant discharge is controlled by a heart shaped cam pressing against the follower on the spool of the 3-way valve which admits air pressure to the pumping unit. The nozzle is carried slightly beyond the center discharge position and then released from the trolley to return to the pick-up position. At the time the lubricant is discharged, the nozzle is tightly sealed against the grease fitting, thus preventing any leakage.

The air control panel on the unit includes a filter, a lubricator and two pressure regulators. One regulator adjusts air pressure which acts on top of the oil reservoir. The follower in the reservoir is subjected to just enough air pressure to give a constant, steady supply of lubricant to the pumping unit. This pressure adjustment is varied in accordance with the viscosity of lubricant used.

A complete range of lubricants from light oils to heavy fiber greases can be pumped by the single acting booster air cylinder, Figure 4. Air pressure acts on the 2 inch diameter piston head. The piston rod end forces lubricant, fed from the reservoir to the lubricating nozzle. Quantity of lubricant discharged into each wheel bearing is easily varied by adjustment of screws which limit the air piston stroke. A range of 0 to .1 cubic inch of fluid is possible with this air cylinder.

Use of this air operated lubricator has reduced maintenance because each wheel bearing is assured of lubricant. It has also been found that power consumption on the conveyor line is reduced because the properly lubricated bearings do not create any drag on the drive.

FIG. 2. THIS VIEW SHOWS the heart shaped plate cam which trips the 3-way air control valve, and the air operated cylinder which pumps the lubricant.

Photos courtesy Ford Motor Company

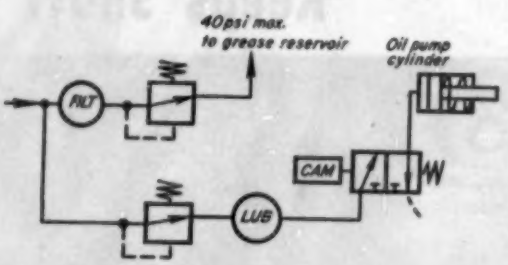


FIG. 3. AIR CIRCUIT for the lubricator includes a special 3-way valve and a special pump cylinder.

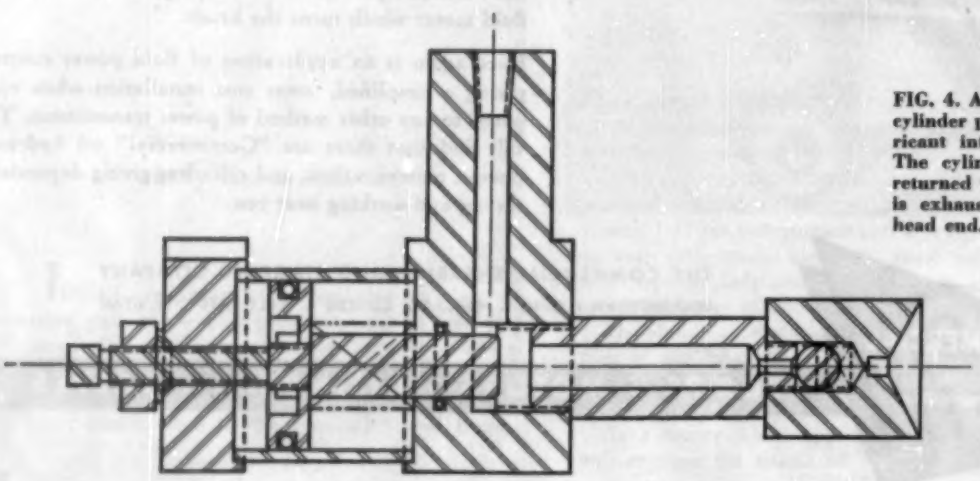
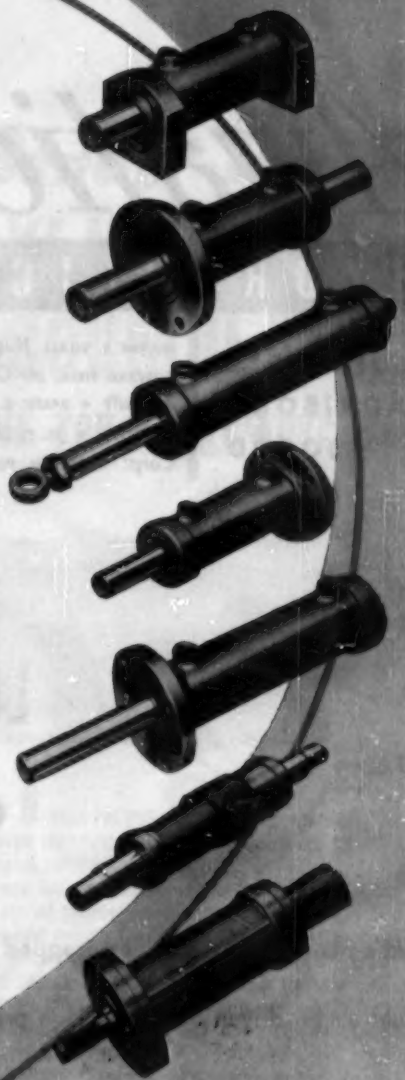


FIG. 4. AIR BOOSTER cylinder pumps the lubricant into the nozzle. The cylinder is spring returned when pressure is exhausted from the head end.

Fill in No. 52 on Reader Service Card

HEAVY DUTY

Hydraulic Cylinders



- All steel construction—no tie rods, no castings.
- Hard chromed and ground piston rod to resist abrasion and prolong seal life.
- Self adjusting seals.
- Five standard mountings.
- Ample rod guide.
- Rod wiper seals fitted as standard.
- Cushioning at either end or both ends of stroke.
- Stroke length to suit your application.
- Standard range 2" to 6" bore, double acting.
- For working pressures up to 1,500 p.s.i.
- Double ended rods available for all standard cylinders.
- Special mountings, larger bores and cylinders for higher pressures by arrangement.

Keelavite *hydraulics*

PUMP/MOTOR UNITS, VALVES, POWER PACKS, TRANSMISSIONS & REMOTE CONTROL SYSTEMS

The recognised Authority on Hydraulic Power Transmission

FOR FULLER INFORMATION PIN THIS CORNER TO YOUR LETTERHEAD and post it to KEELAVITE ROTARY PUMPS AND MOTORS LIMITED ALLESLEY Coventry England

● KEELAVITE ROTARY PUMPS & MOTORS LTD., ALLESLEY, COVENTRY, ENGLAND
Telephone : Meriden 225/6 Telegrams : Keelavite, Coventry

Aviation Section

HYDRAULICS · PNEUMATICS

EDITORIAL ADVISORY BOARD

WAYNE L. BOALS *Hughes Aircraft Company* • HARRY CORNISH *Douglas Aircraft Co., Inc.* HOWARD FIELD, JR. *Consolidated Vultee Aircraft Corp.* • DWIGHT E. LEACH *Chance Vought Aircraft* • RALPH E. MIDDLETON *Lockheed Aircraft Corp.* • FRANK MITTELL *North American Aviation.* • W. F. TALBOT *Northrop Aircraft, Inc.* • PHILIP MUSA *Grumman Aircraft Engr. Corp.* • FRED H. POLLARD *Republic Aviation Corp.* • HAROLD E. WELLS *Bell Aircraft Corp.*

LOW PRESSURE BLEEDING

of aircraft brake systems

What's the best way to bleed trapped air from a hydraulic circuit?

Should air be driven out under high pressure or is the use of low pressure more effective?

● By Robert Spurr

Study of the compressibility characteristics of air shows that low pressure bleeding of hydraulic systems is often more effective than high pressure bleeding. A bubble of air existing in a hydraulic system, such as may be trapped in the blind end of a cross-drilled passage, can become greatly reduced in size if pressure is applied. It may thus be too small and too remote from the flow stream, to be drawn off with the flow. If pressure is reduced, this same bubble can expand until it presents a greater volume of air to the flow stream, and will permit itself to be bled out more easily. Perhaps "led" out would be a better term to describe this point.

WHILE air in any hydraulic system can cause trouble, air in an aircraft brake system can cause disaster. Considerable effort has been made to minimize trapping of air and to develop a means of simply and completely bleeding the system when air is present. Work carried on at Canadair, Ltd., indicates that low pressure bleeding is effective. Their low pressure bleeding technique can be applied, with equal effectiveness, to hydraulic systems on equipment other than aircraft.

ROBERT SPURR, *Functioneer, Functional Procedures Section Engineering Department, Canadair Ltd., Montreal, Canada.*

EFFECT OF HIGH PRESSURE

Applying the formula $V_1 = \frac{V_2 \times P_2}{P_1}$, assuming isothermal expansion, we find that if a body of air is confined in an overshot drilled bore, ¼ inch diameter

Bendix-Pacific CYLINDRICAL ACCUMULATORS

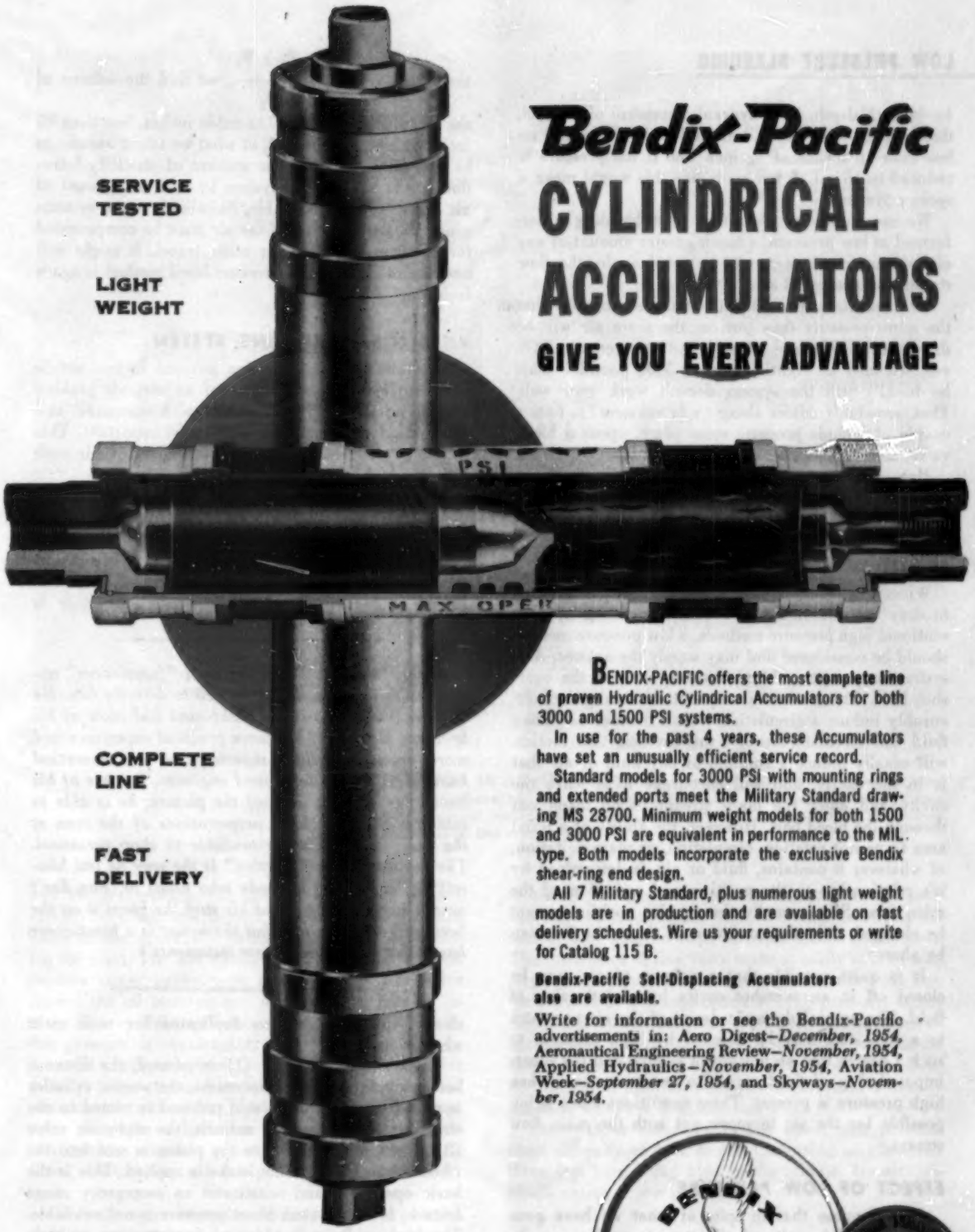
GIVE YOU EVERY ADVANTAGE

SERVICE TESTED

LIGHT WEIGHT

COMPLETE LINE

FAST DELIVERY



BENDIX-PACIFIC offers the most complete line of proven Hydraulic Cylindrical Accumulators for both 3000 and 1500 PSI systems.

In use for the past 4 years, these Accumulators have set an unusually efficient service record.

Standard models for 3000 PSI with mounting rings and extended ports meet the Military Standard drawing MS 28700. Minimum weight models for both 1500 and 3000 PSI are equivalent in performance to the MIL. type. Both models incorporate the exclusive Bendix shear-ring end design.

All 7 Military Standard, plus numerous light weight models are in production and are available on fast delivery schedules. Wire us your requirements or write for Catalog 115 B.

Bendix-Pacific Self-Displacing Accumulators also are available.

Write for information or see the Bendix-Pacific advertisements in: Aero Digest—*December, 1954*, Aeronautical Engineering Review—*November, 1954*, Applied Hydraulics—*November, 1954*, Aviation Week—*September 27, 1954*, and Skyways—*November, 1954*.

BENDIX PACIFIC

PACIFIC DIVISION • Bendix Aviation Corporation
11600 Sherman Way, North Hollywood, California

East Coast Office: 475 5th Ave., N.Y. 17
Export Division: Bendix International 205 E. 42nd St., N.Y. 17
Canadian Distributors: Aviation Electric, Ltd., Montreal 9

by ½ inch depth, by a hydraulic pressure of 500 psi, this same body of air will expand and will occupy no less than 16 inches of ¼ inch line if the pressure is reduced to 15 psi. A few spots like this would make a spongy system.

We can plainly see then, that when bleeding is performed at low pressure, a much greater amount of any air present in a system can be acted on by the flow stream and gently led away.

Yet, operators generally adopt the assumption that the more pressure they put on, the more air will be driven out. We have often heard the remark, "Oh yes, it's bled all right. I gave it 5000 pounds! *Must* be bled!" Still the system doesn't work very well. Then somebody comes along (a functioneer?), puts a couple of pounds pressure some place, opens a bleed valve, and out plops a big blob of air!

How much air, initially pressure-free, could be rammed into that ¼ by ½ inch overshot hole at 5000 psi?

EFFECT OF BLIND CAVITIES

When a hydraulic system is encountered which seems to defy the attainment of adequate bleeding by conventional high pressure methods, a low pressure method should be considered and may supply the answer. Any system may contain blind cavities, such as the overshot hole. These cavities may not be arranged to favorably induce a circulation within themselves. When fluid can circulate through the cavities, this motion will usually induce a rotation of any fluid or air that is in the cavity, and will encourage it to leave the cavity and enter the main stream to be taken out through the bleed port. However, the ability of a blind area to permit rotation, circulation, or plain agitation, of whatever it contains, fluid or air, is determined by it's relationship to the position and condition of the main flow. Since usually the relative position cannot be changed, only the condition of the main flow can be altered.

It is quite possible that a volume of air may be closed off in an overshot cavity by a static slug of fluid. The natural dynamic desire of the air to return to a free state may be damped by high pressure to such a degree that no movement occurs, and the superimposed slug of fluid may also resist rotation, when high pressure is present. These conditions make it impossible for the air to move out with the main flow stream.

EFFECT OF LOW PRESSURE

Now suppose that in spite of what we have gone through, and in spite of all attempts we have made, our friend the overshot drilled hole, measuring again ¼ inch diameter by ½ inch long, persists in holding air. Suppose then that again the least amount of pressure we can apply in 15 psi. We have bled at this pressure, yet air remains in the hole. What will be the volume of the air at 500 psi? Again assuming isothermal compression for purposes of illustration, and applying the formula $V_2 = \frac{P_1 \times V_1}{P_2}$, we find the volume of the air will become .000735 cubic inches, less than ⅛ inch diameter if spherical, at what we might assume to be operating pressure. The amount of elasticity introduced into a hydraulic system by such an amount of air might not be noticeable, likewise in some systems where the compression of the air must be compensated for in terms of piston, or other travel, it might still not be noticed. The low pressure bleed method is again favorable.

AN AIRCRAFT BRAKING SYSTEM

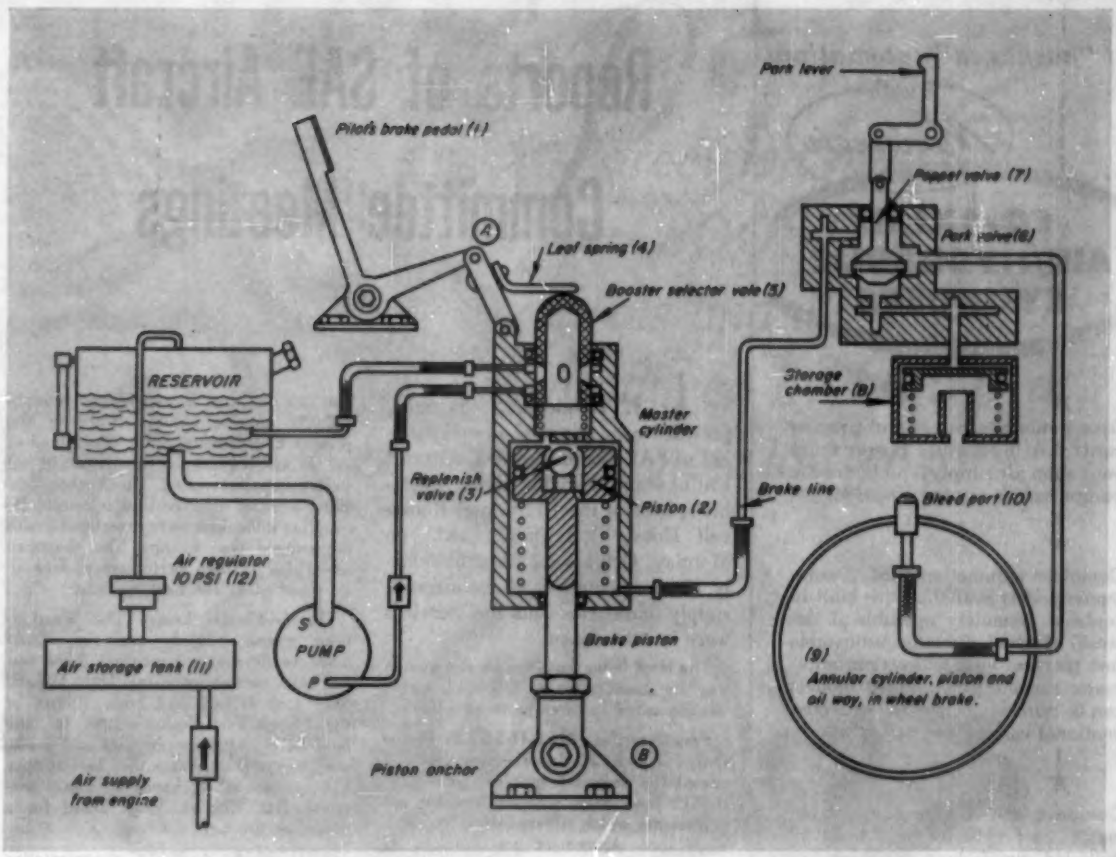
The theories and reasoning pursued in this article were applied to the bleeding of an aircraft braking system at Canadair, in which solid operation and elimination of travel loss were very important. This braking system had defied the attainment of adequate bleeding by high pressure methods.

It will be seen in the accompanying illustration that this aircraft uses a boost braking system, main system pressure acting in the master cylinder to augment pilot effort, pilot effort is also limited by the boost selector to prevent excessive pressure at the wheel brake, or brakes. One train of brake units only is shown, this is of course duplicated for each main wheel.

Author's note: *Since the term "functioneer" appears in this article, it may be well to describe him. He is an engineer who is not deskbound like most of his brothers. He usually has more practical experience and more practical ability, superimposed on theoretical knowledge, than a deskbound engineer. Because of his knowledge of both sides of the picture, he is able to interpret the often lofty perpetrations of the man at the desk, in terms understandable to shop personnel. The keynote of his "function" is the way he lets himself be "got at" by anybody who wants to. You don't need a stepladder to get at his stuff, he keeps it on the bottom shelf. (The fact that the writer is a functioneer has nothing to do with these statements.)*

When the pilot's pedal (1) is pressed, the distance between points A and B increases, the master cylinder is pulled up, since the piston rod end is rooted to the structure, the piston (2) extends, the replenish valve (3) closes, and fluid below the piston is sent into the wheel brake unit and the brake is applied. This is the basic operation, and constitutes an emergency usage feature, in case system boost pressure is not available. The braking force is obtained by squeezing multiple discs, through the extension of an annular piston, backed by an annular "Vee" ring, working in an annular groove in the brake housing. This groove alone can present considerable bleeding difficulty.

When the pedal is pressed and the master cylinder is pulled in normal use, main system pressure at 3000 psi is usually available, the cylinder tends to straighten,



COMPONENTS IN AN AIRCRAFT brake system have many passages and drilled holes where air can be trapped. Complete bleeding is accomplished by circulating oil under low pressure. Low pressure is applied by air acting above the oil in the reservoir.

and the leaf spring (4) presses the boost selector valve (5) down and admits system pressure, which bears on the upper side of the piston (2) thus assisting the pilot. The leaf spring has a preset value which permits rising pressure to return the selector valve toward the off position and so bypass pressure to return, thereby limiting brake pressure safely. Usually this pressure is regulated around 500 psi maximum. Note the overshot hole under the dome of the selector valve, it is exaggerated in the sketch but does exist to some extent in the part. The replenish valve is always open when the cylinder is relaxed, to replace lost fluid and to maintain prime in the brake system. It closes when the cylinder is pulled and the piston extends.

The park valve (6) is a device to store hydraulic pressure against spring load, to maintain brakes on when required. To park the brake, pressure is applied by pedal operation, then the park lever is moved to traverse the poppet valve (7) to the opposite seat, pressure is thus admitted to the storage chamber (8) and pressure is held in the brake when the pedal is released.

This park valve is a box of tricks when it comes to bleeding, it has many inaccessible and remote cavities, and although again these are exaggerated in the sketch, they also do exist to some extent in the part. The intricacies of this valve make it easily able to trap large volumes of air when they are compressed into the cavities by the application of high pressure. It has responded well to the more gentle low pressure bleeding method. The trick here is to place the park handle half way, so that the poppet valve is off both seats, and to course fluid through at low pressure, it usually yields to complete bleeding this way.

The annular ring (9) in the wheel unit presents some difficulty as it is, in effect, a closed length about three feet long being bled in the middle. It certainly bleeds easier at low pressure.

BLEEDING THE AIRCRAFT BRAKING SYSTEM

The brake system discussed here lends itself very well to low pressure bleeding. It may not be so easily attainable in other systems. If we now take a closer look at the illustration, we will see that the brake is shown with the mechanism relaxed, and we can follow a

Concluded on page 88

Get "packaged" automation

-with-

Modernair

CO-AXIAL AIR/HYDRAULIC CYLINDERS

Give you smoothness and precise control of hydraulic power from your shop air supply – no hydraulic pumps, valves or piping needed.

Complete automation unit . . . automatic models available with built-in controls (remotely operable if desired) of speed, direction, adjustable fast traverse either direction, automatic recycling. Standard models can be remotely controlled with conventional valving and piping.

Compact, self-cooling co-axial design . . . air cylinder surrounds oil cylinder, avoids long, bulky in-line design. Expanding exhaust air cools the oil.

Wide application range; uses standard MODERNAIR cylinder mountings; develops thrust of 3.14 x airline pressure, or 2.7 in pull. Any stroke to 72". Ideal for tool or work piece feeds, and other automatic motions requiring precise speed control.

Modernize your tools now with low cost MODERNAIR Co-Axial Hydraulic cylinders and pneumatic control valves. Cylinders, valves and parts stocked in principal U. S. and Canadian cities. Call your authorized dealer, or write us now for helpful engineering data, specifications and prices.

3

Modernair CORPORATION

Room 12A, 400 Prada St. • San Leandro, Calif.

Reports of SAE Aircraft Committee Meetings

L. J. Henderson, chairman, presided over the semi-annual meeting of SAE Committee A-3, Aircraft Fittings and Flexible Hose Assemblies, held at the Hollywood Roosevelt Hotel, Hollywood, Calif., on Monday, October 11. Approximately 70 representatives of the aircraft, supply industries and the Services were in attendance.

The most important item on the agenda was the specification MIL-H-5512, which was discussed in three parts as follows:

Specification MIL-H-5512 Hose Only: The B. F. Goodrich member discussed the proposed spec covering MIL-H-5512 hose only, pointing out the requirements which differed from the previous spec. Agreement was reached on five changes, the most important of which was the number of impulse cycles to be added. The discussion developed that present impulse test machines varied considerably and it was agreed that the machine at WADC should probably be used as a referee machine and an effort made to correlate equipment. The B. F. Goodrich and U. S. Rubber members were asked to send 20 hose assemblies each of -10 size to WADC for checking and to run the same tests on their own machines to determine their performance in reference to the referee machine.

Specification—Hose Assemblies Using MIL-H-5512 Hose: The Anchor Coupling member reviewed the proposed draft spec covering Hose Assemblies, Aircraft Hydraulic and Pneumatic, High Pressure, 3000 psi. Three changes were agreed upon and will be incorporated in the proposed spec which will be submitted to SAE for transmittal to ASG.

Specification—Hose Ends Used with MIL-H-5512 Hose: The Anchor Coupling member also reviewed the proposed spec for Fitting Ends, Hydraulic and Pneumatic High Pressure Hose. The subcommittee agreed on five changes which will be made in the proposed spec.

High Pressure Hose—Spiral Wrap: The Aeroquip representative reported that further work is being done on spiral wrap type hose. Preliminary tests indicate that much improved impulse life can be expected from this type hose. Tests indicate that the -12 size is capable of running 160,000 impulse cycles. However, the present hose is suitable for -55 instead of -65 F and cannot be immersed in oil before impulse cycling. The Anchor Coupling member reported similar results. No coupling difficulties were experienced with the swaged type fittings. The chairman asked for further performance data to be reported at the next meeting.

Hose—Flame Tests: The Weatherhead member briefly reviewed efforts made to develop a consistent flame test for hose assemblies using both MIL-H-5511 and MIL-H-5512 hose. Efforts of the Flame Test Subcommittee to date have narrowed the equipment and procedure to the point where they believe they have a reasonable chance to obtain adequate data. The chairman asked for a report at the next meeting.

AND10050: A WADC representative stated that the Aircraft Equipment Testing Co. is conducting tests on all metal bosses in sizes -5, -8, and -12 and that performance information will be available within two months. A combined impulse and vibration test is being made and 200,000 impulse cycles has been set up as the goal for seals of this type.

Tube Fittings—MS: A WADC representative stated that the Air Force is planning to use MS flareless fittings on hydraulic and pneumatic systems in all future aircraft. The AN flare type fitting will be phased out. The Republic Aviation member asked for a QPL on MS flareless fittings or suitable requirements to insure adequate quality control.

The chairman stated that the next meeting of the Committee would be held in Montreal, Canada, April 25, 1955.

THE SAE A-6C Sub-Committee, Hydraulic Pumps, Motors and Air Compressors, held their regular fall meeting on Tuesday, October 12 at the Hollywood Roosevelt Hotel, Hollywood, Calif. Chairman Harry Cornish presided over a group of nearly 80 representatives of airframe, airline, engine, suppliers and the Services.

Precision made BOOSTER flight controls and ACTUATORS produced by LOUD at new low cost

Today's airplane is no longer controlled in flight by manpower alone. Hydraulic power is now widely employed to provide control surface power made necessary by larger surfaces and higher speeds.

This substitution of manpower with hydraulic power has made the production of high precision hydraulic components vital. Loud is now producing this equipment with diametral tolerances of .000025 inches and controlled clearances of .00005 inches on a quantity production and quality controlled basis. Linear tolerances in valving of .00005 inches insure controls of instantaneous and identical response.

Loud's complete facilities from raw material to finished product, a machine for every job, plus years of experience has made it possible to produce these precision assemblies for the aircraft industry at mass production prices.

"PRODUCING TODAY . . . TOMORROW'S AIRCRAFT REQUIREMENTS"

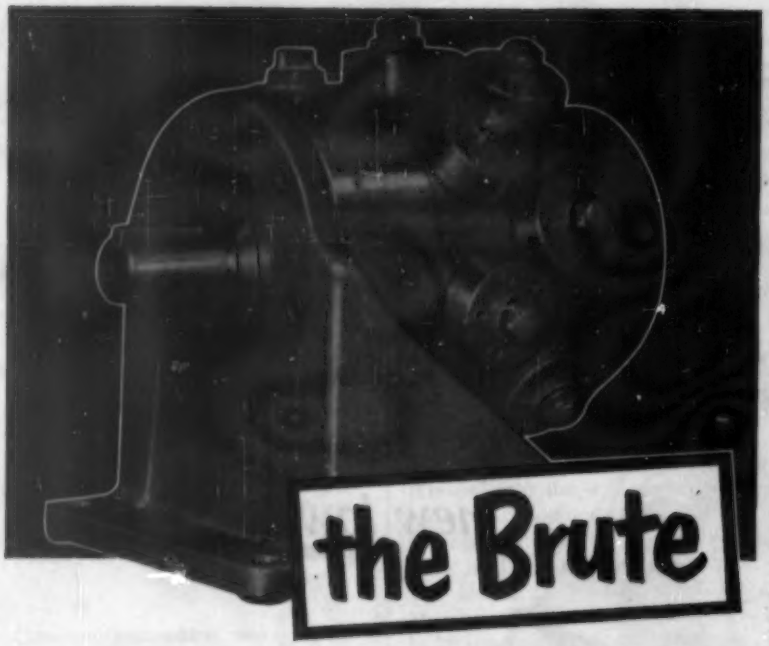
Engineering and design development by
Haskel Engineering Associates
Glendale, California

National Sales and Service by
Haskel-Loud Aircraft Service Corp.
Glendale, California

Resident Sales Engineers located in
Seattle, Wash.
Kansas City (Independence), Mo.
Baltimore, Md.

H. W. LOUD MACHINE WORKS, INC.

969 EAST SECOND STREET, DEPT. 11 • POMONA, CALIFORNIA



This Series C SECO heavy duty pump has been aptly termed the "Brute" of all hydraulic pumps. The Brute is the rugged, revolutionary answer to high horsepower, high pressure demands. It opens new horizons in the use of oil hydraulic power.

Pressure is developed *within hollow pistons*—a patented feature of SECO pumps—making possible extremely high pressures without loss of mechanical efficiency. Each piston assembly is completely surrounded by high pressure lubrication and literally floats in a hydrostatic film of oil during its power stroke. *Fluid timed* ball check valves insure quiet and efficient operation at all pressures.

The Brute is at present made in two models, with the following characteristics:

MODEL	C-11	C-5
MAX. PRESSURE-SPOT RATING—PSI	5,000	10,000
MAX. PRESSURE-CONT. RATING—PSI	4,000	6,000
DELIVERY AT MAX. PRESS. G.P.M.	10	5
SPEED.....R.P.M.	1170	1170
H.P. INPUT AT MAX. PRESSURE	35	38

If you are interested in high horsepower, high pressure hydraulic power, please send for complete information on SECO Series C Pumps.

Simplex Engineering Co., Zanesville, Ohio

SECO

SIMPLEX ENGINEERING CO.
Zanesville, Ohio

Please send me complete information on SECO Series C pumps.

Name_____ Title_____

Company_____

Address_____

SAE Reports

Continued

Pumps Hydraulic, Power Driven, Variable Delivery, MIL-P-7740B: The recommendations of the subcommittee were reported in the hands of BuAer for study. It is expected that these revisions will be incorporated in the proposed "B" revision of the spec. The variable delivery, high speed recommendations were reported sent by AIA to ASG.

Guided Missile Hydraulic Requirements: The North American representative reported on the results of SAE Survey A-6C-1, Missile and Pilotless Airplane Hydraulic Pumps. The report was very complete and discussed numerous differences between piloted and pilotless aircraft hydraulic pumps, performance and environmental requirements. The subcommittee agreed that it was premature to attempt a formal spec at present. Members agreed that it could be desirable, however, to define and attempt to standardize certain parameters expected to be of importance. A panel of six, with the North American member as chairman was decided upon to prepare an SAE aeronautical recommended practice for use of pump manufacturers.

High Temperature Hydraulic Pump Specification: The Sundstrand member reported that the results of a survey were not available. The chair asked that the work continue and a report be made at the next meeting.

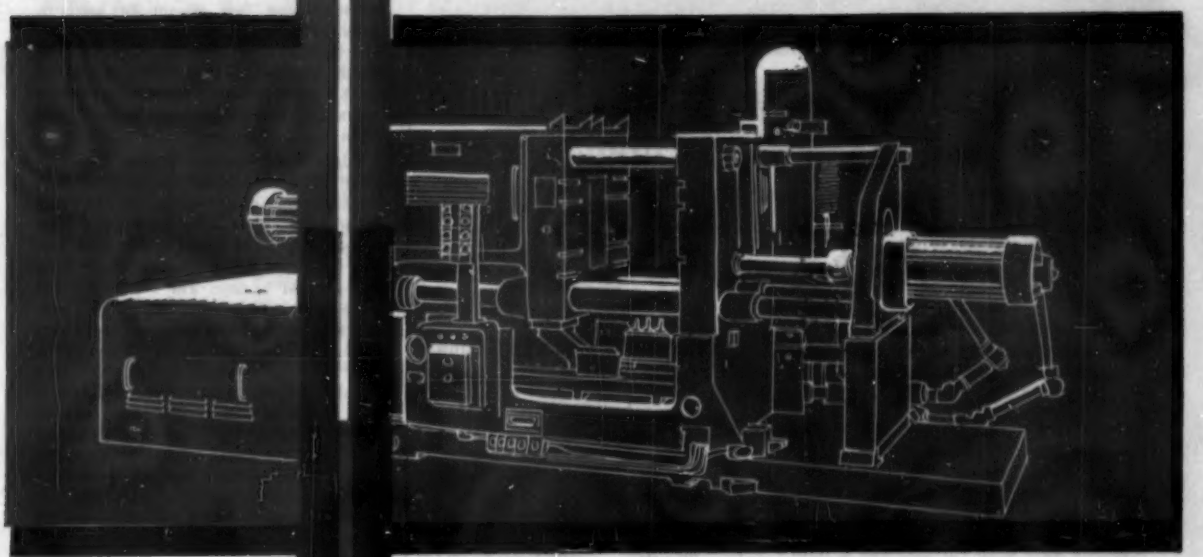
AND20000 Series Standard Drives: The Pratt & Whitney Aircraft member reported that SAE Committee AE-1, Joint Aircraft Engine and Accessory Installations, had accepted this subcommittee's recommendations of April 1954—that the maximum accessory drive pad speed for high speed hydraulic pumps should be 8000 rpm at maximum engine speed and that this would be the absolute maximum drive pad speed except for negligible engine maximum speed tolerances.

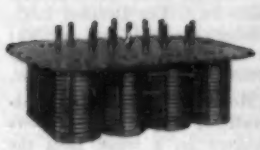
5000 psi Varible Delivery Hydraulic Pump Specification: The Denison Engineering member stated that comments on the survey circulated to industry had not been received for reporting. Discussion indicated that considerable detail study must be done on the present version of the spec. The chairman set up a panel of seven members with the Denison member as chairman to take care of the large volume of detail work involved. The panel is to prepare a rough draft spec before the next meeting.

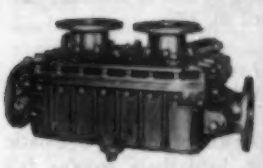
Air Compressor Specifications, MIL-C-6388A, 8215, 8216 and 65-91A: The Cornelius Co. member reported that the Services are currently preparing six specs on air compressors; three are general specs covering engine, electric motor and hydraulically driven compressors and three are detail model specs for use with the general specs. The subcommittee will withhold further work pending receipt of the draft copies.

Hydraulic Pump Specification, General Consideration: The Hamilton

TEMPERATURES MADE TO ORDER!







Harrison cools the hydraulics! Huge hydraulic presses demand a dependable, high-efficiency oil cooler. That's why so many manufacturers choose Harrison. Temperature of Harrison-cooled hydraulic equipment is always under control . . . thanks to these space-saving, money-saving oil coolers. For every Harrison heat exchanger has the engineering experience and skill of forty-four years behind it. What's more, you'll find that Harrison has the most modern and extensive research facilities in the business. If you have a hot or cold problem . . . look to Harrison for the answer.

HARRISON

RADIATOR DIVISION
GENERAL MOTORS CORP.
LOCKPORT, N. Y.

Continued

Standard representative presented a revised concept for preparation of military pump spec as described in a paper "A New Approach to the Problem of Writing MIL Specifications for Power Driven, Variable Hydraulic Pumps". The report evoked considerable discussion. The basic idea is to establish a single general specification for a basic class of pump and shorter detail specs for items peculiar to specific pumps. This won endorsement and the work is to be continued by a panel of six with the Hamilton Standard representative as chairman.

5000 psi Pump Test Stand Circuits: The Denison member continued the discussion from last meeting on the difficulties encountered with test circuits for 5000 psi hydraulic systems. Trouble was reported with strength of all components. Considerable leakage was traced to fretting at the flare of the tubing. When heavier wall thickness in smaller size tubes were used, flares tended to split during fabrication.

Hydraulic Pump Inlet Pressure and Pump Response Time: The General Electric member reviewed basic laws of physics governing pump pressurization and stability in response of self-regulating pump systems. He believes that future requirements will demand more careful attention to basic laws when establishing reservoir pressures, suction line systems and the effects of hydraulic system configuration as regards stability in response of self-regulating pump systems.

Qualification Tests of Fluids: A BuAer representative requested the subcommittee to define the class and type of equipment that should be used in qualification tests of new hydraulic fluids. The chairman asked the Republic and the North American (Downey) members to draft a letter outlining the subcommittee's views; the chairman will forward this letter to the Services.

High Temperature Pump Testing: Four members reported on tests on high temperature pump testing. A Hamilton Standard representative reported a high speed pump being tested at 350 F on OS-45-1 fluid. No major obstacles have been encountered to date. The New York Air Brake member remarked that, in his opinion, most pump manufacturers could provide units for satisfactory operation at 350 F, if a solution to the "O" ring problem could be found. His estimate is that a life of 100 to 200 hours can be provided under the worst combination of operating conditions at this temperature. The Bendix member reported a contract for the development of a pump and motor to operate at 550 F and 7500 rpm for 10 hours and another for the development of a 10 gpm pump to operate at 550 F for 500 hours. Both of these developments use MLO-8200 fluid. The Denison Engineering member reported that he was working on a pump operating at 325 F on MIL-O-7808 with good results so far.

Electric Motor Flanges for Mounting Hydraulic Pumps: The Vickers member reported on a letter from the chairman of Subcommittee A-2M, Motors, advising that standards have been set up for flanges on standard motors and suggesting that hydraulic pump manufacturers attempt to design their pump flanges to mate with these flanges. The Vickers member pointed out the difference between requirements for engine pump drive pads and those of the motor flanges. The subcommittee directed this member to write Subcommittee A-2M, agreed that standardization was desirable but pointing out the rather large basic differences and requirements which might prevent such standardization.

The chairman announced that the next meeting would be held in Montreal, Canada on April 26, 1955.

THE SAE A-6 Committee, Aircraft Hydraulic and Pneumatic Equipment, held their regular fall meeting at the Hollywood Roosevelt

SUPERIOR Announces New SAE Hydraulic Low-Carbon Steel Tubing

Practically Eliminates Tubing Failure in Critical Hydraulic Systems

Newest product to brighten the eyes of hydraulic engineers and designers is a low-carbon steel tubing that practically eliminates tube failure in hydraulic systems.

JIC specifications were a long step in this direction. Superior's SAE hydraulic tubing goes even further. 100% hydrostatic testing is at pressures which raise the fibre stress to 15,000 psi—in many sizes well above the 1,000 psi minimum required by these specifications. This contributes to greater safety at higher work and surge pressures. Also, we aim for a carbon content of .12% maximum, for ease of bending and flaring. Tube billets are made under special melting practice to insure a NON-AGING type of tubing with low yield strength and high elongation.

If you use hydraulic tubing—and if you want exact analysis, outstanding fabricating ease, and minutely accurate dimensions—specify Superior. Send for Catalog Section 30 and name of your nearest Superior distributor. Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

COMPARISON OF SPECIFICATIONS

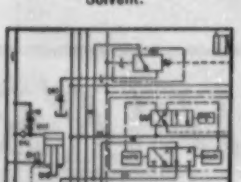
Seamless Low-Carbon Steel Tubing

Detail	JIC	SAE
Check Analysis:		
Carbon	.08-.18	.05-.15
Manganese	.30-.60	.30-.60
Phosphorus	.05 max.	.040 max.
Sulphur	.055 max.	.050 max.
Physicals:		
Ultimate	55,000 psi max.	60,000 psi max.
Yield	— —	25,000/ 45,000 psi
Elong. 2" a)⅛" O.D. x .035" wall and over	40% min.	35% min.
b)Under ⅛" O.D. x .035" wall	30% min.	30% min.
Misc. Tests		
Flare	4" section expanded over mandrel having a 60° angle until inside diameter is increased 30%	
Flattening	3" section flattened to 3 x wall thickness	
Hydrostatic	Not less than 1,000 lbs. pressure	
Corrosion Protection	The corrosion preventive oil used shall be such that after extended storage periods it can readily be removed with an alkaline cleaning solution or Stoddard Solvent.	

Superior Tube

THE BIG NAME IN SMALL TUBING

All Analyses .010" to ½" O.D.
Certain Analyses in light walls up to 2½" O.D.



Partial plan of complex hydraulic system.

Hotel, Hollywood, Calif., on Wednesday, Thursday and Friday, October 13, 14 and 15. A total of 222 persons, representing the airframe and airline industries, suppliers of components, systems materials and services and the Services were registered. Chairman B. R. Teree presided over one of the busiest and most widely participated in meetings ever held by this Committee.

A group of pneumatic items were first on the agenda the first morning.

Valve, Pneumatic Check MIL-V-8628 (Aer): The Walter Kidde representative (A. H. Hobelmann, chairman of the Pneumatic subcommittee of A-6) advised that the comments received on this spec had been forwarded to BuAer; BuAer promised the issuance of the spec within 30 days.

Pneumatic Systems; Design, Installation and Tests in Aircraft MIL-P-5518: The Republic Aviation member reported that the revised draft of this spec had been forwarded to the SAE office for service coordination. Objections to certain points in the spec by Chance Vought were discussed, changes agreed upon; the chairman asked the SAE office to forward these recommendations to the Services.

Specification, Pneumatic Components MIL-P-8564 (ASG): The Chance Vought member discussed the results of Survey SAE A-6-87-1, presenting a summary of replies and a proposed revision "B". A total of 16 changes were suggested and commented upon. There was considerable discussion on a point raised by the Adel member regarding the information to be furnished on equipment nameplates. Because of its importance, the chairman appointed a panel of seven suppliers with the Adel member as chairman to prepare recommendations and report back at the next meeting.

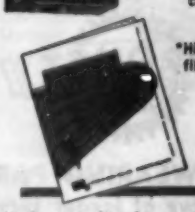
New Pneumatic Specifications: BuAer has prepared a spec on a self-sealing, quick-disconnect coupling which is now in the hands of interested equipment people. BuAer is preparing a draft of a spec on a pressure switch and asked for comments in the next 60 days. Seven airframe and supplier companies indicated that they would send such comments or suggestions. The search for a better pneumatic lubricating grease (MIL-L-4343) continues. The Walter Kidde representative reported that the present grease is not suitable for use with silicone "O' rings and at temperatures in excess of 300 F. Discussion developed that temperature limits for grease should be specified, that the packing problem in pneumatic equipment is definitely different than the same problem in hydraulic equipment and that no additional information regarding MIL-L-4343 grease has been forthcoming. The chairman turned the problem over to the "O" Ring panel, of which the Precision Rubber Products representative is the chairman, and asked

ADEL Hydraulic
SHUT OFF VALVES
(Solenoid Operated)
PRODUCED TO RIGID AIRCRAFT STANDARDS

26038 WITH INTEGRAL RELIEF.
NORMALLY CLOSED.
¼" and ⅜" LINE SIZES.
Operating pressure: 350 psi;
Relieves inlet to outlet within 500 to 700 psi range.
Weight: 0.60 lb.
(Also available in 1500 and 3000 psi capacities.)

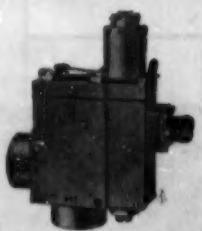
*25853 PILOT OPERATED.
NORMALLY CLOSED.
⅜" and ½" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 1.45 lb.
(Also available with manual override or normally open.)

*26610 PILOT OPERATED.
NORMALLY OPEN.
¼" and ⅜" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 0.81 lb.
(Also available normally closed.)



*High Flow Capacity Valve with filtered pilot circuit.

FLUID: Specs. MIL-O-5606 or MIL-F-7083.
ELECTRICAL RANGE: 18-30 VDC.
SOLENOID DUTY: Continuous.
CURRENT DRAIN: 0.5 Amp at 24 VDC.
TEMPERATURE RANGE: −65°F to +250°F.
LIGHTWEIGHT, COMPACT, CORROSION RESISTANT CONSTRUCTION.



*25670 PILOT OPERATED. WITH MANUAL OVERRIDE.
NORMALLY CLOSED.
¾" and ⅝" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 1.58 lb.
(Also available normally open without manual override.)

Write for new, descriptive Brochure containing detailed information on ADEL's line of Aircraft Equipment and facilities. Address ADEL DIVISION, GENERAL METALS CORPORATION, 10759 Van Owen St., Burbank, Calif.

ADEL produces a complete line of Aircraft HYDRAULIC & PNEUMATIC CONTROL EQUIPMENT, HEATER, ANTI-ICING & FUEL SYSTEM EQUIPMENT, ENGINE ACCESSORIES AND LINE SUPPORTS.

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL METALS CORPORATION • BURBANK, CALIF. • HUNTINGTON, W. VA.

CANADIAN REPRESENTATIVE: RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

Fill in No. 17 on Reader Service Card

COMPACT DEPENDABLE EFFICIENT

Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS

It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

BHEW

Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.

BENTON HARBOR ENGINEERING WORKS, Inc.

BENTON HARBOR, MICHIGAN

"We Have Had Considerable Success in the Use of Promet type Bearing Material in Our Pumps For Gasoline Service"

—says one of America's largest pump manufacturers. But that's what they all say.

You, too, should get acquainted with

PROMET
Metallurgically Bonded BRONZE

BEARINGS . . . BUSHINGS . . . WEARING PARTS

They're sold with a money-back guarantee of longer service.

Castings to your patterns — any size, shape or section — delivered as scheduled and specified. Pattern making, designing and machining when required.

Write for free literature and service data sheets. Send blueprints, conditions of operation and other data for recommendations and quotations. You are invited to discuss your bearing problems with our metallurgists, engineers, and laboratory technicians.

THE AMERICAN CRUCIBLE PRODUCTS CO.
"Bearing Specialists Since 1919"
1303 Oberlin Avenue Lorain, Ohio, U. S. A.

SAE Reports

Continued

for a progress report at the next meeting.

The chairman of the Pneumatic subcommittee announced that BuAer has available a report prepared by the National Bureau of Standards, NBS-3683 "Contributions to the Method of Calculation and Measurement of Pressure Drop in Pneumatic Components and Systems". The report contains valuable information on the design parameters and characteristics of pneumatic flow of interest to both manufacturers and users of pneumatic equipment. Copies may be obtained by writing to The Department of the Navy, Bureau of Aeronautics (AE-62), Washington 25, D. C.

The hydraulic items were initiated with discussions of high temperature hydraulic systems, divided in two sections 275 F systems and 400 F systems.

High Temperature Hydraulic Systems—275F: The Pantex representative reported that there was no agreement among airframe manufacturers regarding the three "O" ring compounds recommended by the Services. The Weston Hydraulics member suggested that the only solution was a MS drawing and a QPL for the packings. BuAer and WADC representatives agreed that a standard packing could be used where temperature permits and that at higher temperatures, where no standard packings or QPL exist, the component manufacturer would have to select a packing on the basis of performance. The WADC representative pointed out that no approved compound for 275 F operation is available and that necessary testing and establishing a QPL would take at least a year.

Because this problem is a serious one to all component manufacturers, the chairman suggested that the Services call a special Service-Industry Conference within 30 to 45 days to establish some means of overcoming the present difficulties. This was approved by the committee.

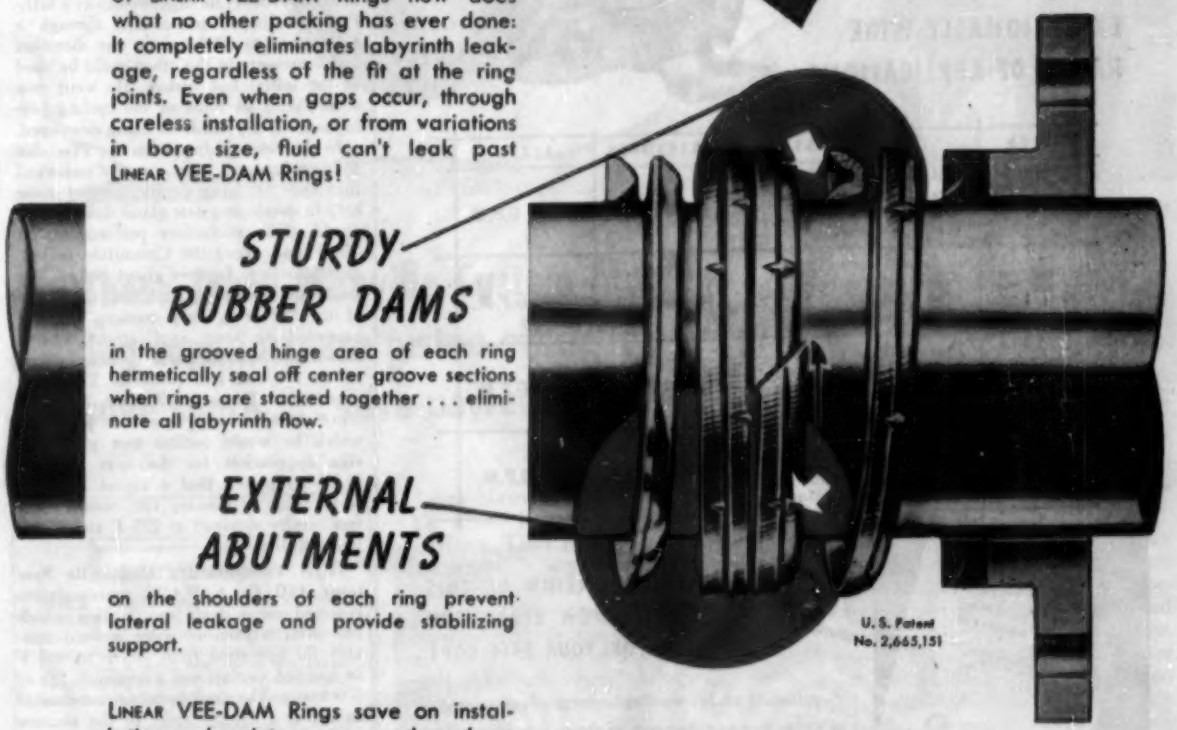
Considerable discussion developed on specific problems introduced by airframe manufacturers. The Lockheed member reported that laboratory tests did not correlate with flight tests; in one case a rod packing failed after 15 hours when the hydraulic system temperature was between 225 and 250 F. All three of the recommended compounds were tried in this application and failures were experienced in each. Similarly, boss seals that had passed laboratory tests failed quickly in flight tests in MIL-O-5606 fluid. He emphasized the primary need as realistic testing to evaluate newer seals. The Northrop representative reported similar packing failures. The Hughes Aircraft member suggested that the best compromise may lie in cooling the hydraulic system in order to obtain safe and reliable systems.

The WADC representative reported that crush tests at 275 F at WADC have correlated well with cycling tests at Douglas and that the Laboratory is currently conducting cycling tests on a test cylinder installed in an oven at 275 F

Here's Terrific NEWS
IN HYDRAULIC PACKINGS

LINEAR VEE-DAM RINGS

Unique, new and revolutionary design of LINEAR VEE-DAM Rings now does what no other packing has ever done: It completely eliminates labyrinth leakage, regardless of the fit at the ring joints. Even when gaps occur, through careless installation, or from variations in bore size, fluid can't leak past LINEAR VEE-DAM Rings!



STURDY RUBBER DAMS

in the grooved hinge area of each ring hermetically seal off center groove sections when rings are stacked together . . . eliminate all labyrinth flow.

EXTERNAL ABUTMENTS

on the shoulders of each ring prevent lateral leakage and provide stabilizing support.

U. S. Patent No. 2,665,151

LINEAR VEE-DAM Rings save on installation and maintenance . . . reduce down time. They last longer, work better! We're molding them in a variety of sizes and compounds. Let us show you how VEE-DAM Rings can solve your packing problems!

"PERFECTLY ENGINEERED PACKINGS"

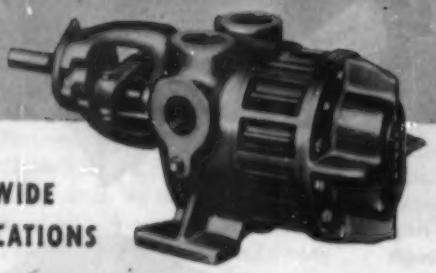
LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

Install

ROPER ROTARY PUMPS

for Positive Results



MODELS FOR AN EXCEPTIONALLY WIDE RANGE OF APPLICATIONS

SERIES F PUMP

SERIES	TYPICAL USES	PRESSURES	SIZES
3600	All Petroleum Handling Grease Compounding Oil Circulating General Transfer	to 60 P.S.I.	40-300 G.P.M.
F	Pressure Lubrication Hydraulic Power Fuel Transfer Lube Oil Transfer	to 300 P.S.I.	1-300 G.P.M.
K	Pressure Lubrication Hydraulic Service Industrial Oil Burner Fuel Supply	to 150 P.S.I.	¼-50 G.P.M.
H	Hydraulic Power Test Equipment Pressure Lubrication High Pressure Coolant	to 1000 P.S.I.	5-75 G.P.M.

NEW! LATEST EDITION OF THIS BOOKLET NOW READY FOR YOU! SEND FOR YOUR FREE COPY

A valuable guide covering important fundamentals of estimating requirements of the average pumping job. It includes tables, charts, sample problems, and other pertinent data. SEND COUPON BELOW.

Geo. D. Roper Corporation, 712 Blackhawk Park Ave., Rockford, Ill.

Please Send Booklet—"How to Solve Pumping Problems"

NAME.....

ADDRESS.....

CITY.....STATE.....

ROPER Rotary Pumps

SAE Reports

Continued

ambient. He reports that all three recommended compounds have passed this test, but with differing leakage rates. Teflon backup rings were used.

A discussion on limiting certain larger size "O" rings to static applications developed exceptions to the AF recommendations. This problem was referred to the Service-Industry Conference.

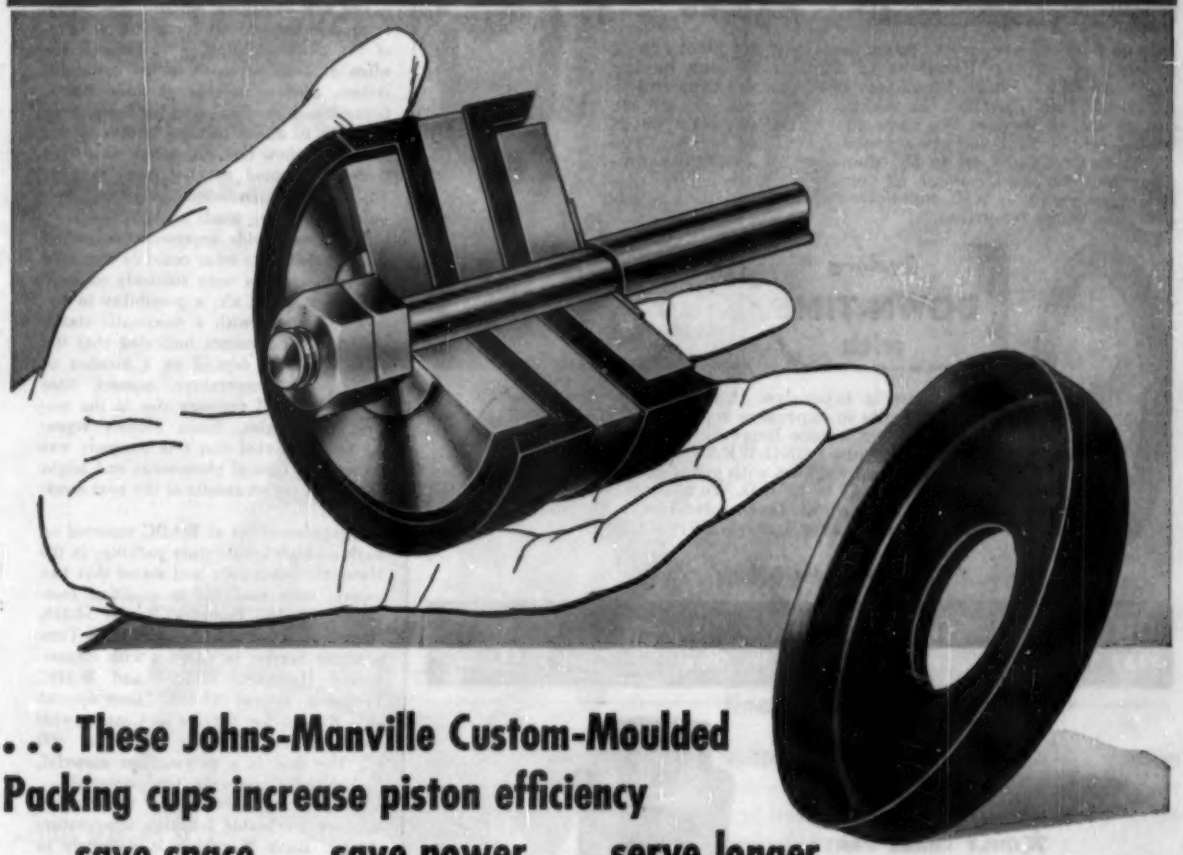
The North American member reviewed the work of Committee W-75 on cycle tests for high temperature hydraulic components and its suggestions regarding the high temperature test program and coordination with A-6. The chair asked the North American member to set up a panel of 6 to 8 hydraulic specialists to work with the Services.

The WADC representative stated that not enough information has been collected to include suitable test procedures in MIL-P-18017; he suggested that a MIL-P-5516 cylinder, pressurized through a hollow rod to 3000 psi on one direction and 0 pressure in the other could be used as the initial test system. He went into some detail on some of the cycling performance test procedures being developed.

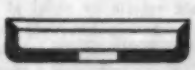
In the ensuing discussion the Precision Rubber Products representative remarked that the "O" ring people needed some help in developing new gland designs that would give satisfactory performance at 275 F and urged the Committee to promote a move to improve gland design. The Lockheed member stated that the limits of the "O" ring as a packing may be exceeded on some applications, adding that a new approach will have to be taken on the rod seal problem. The chair asked the Precision Rubber Products representative to prepare a paper in which he would outline new gland design approaches for the next meeting. WADC reported that a report expected to be ready in January 1955 would cover test results obtained at 275 F and 550 F temperatures.

High Temperature Hydraulic Systems 400 F: A WADC representative reported on a draft specification which has been written to cover a fluid suitable for operation from –65 F to 400 F in manned aircraft and a minimum life of 500 hours. The draft is being coordinated to act as a referee spec. In the absence of tests, procedure and requirements have been formulated from extrapolation of the low temperature conditions. He pointed out that several factors have been found to be important in evaluating a fluid on a chemical basis: (1) Viscosity—objectives of no more than 2500 centistokes at –65 F and no less than 2.5 Centistokes at 400 F; (2) Oxidation corrosion requirement; (3) Hydrolytic stability; (4) Spontaneous ignition temperature—a minimum of 700 F is desired; (5) Foaming and foam stability; and (6) Rubber swell tests –limit established is 25 plus or minus 5 percent. Five fluids have been evaluated, two of which, the OS45 silicate type and the 8515 fluids (MLO-8200 fluid

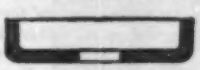
Looking for a more efficient piston design?



. . . These Johns-Manville Custom-Moulded Packing cups increase piston efficiency . . . save space . . . save power . . . serve longer



TYPE A . . . The Type "A" J-M Moulded Packing Cup is the "standard" for use on the pistons of pumps and on various hydraulic and pneumatic mechanisms. The lip forms a tight seal under discharge pressure, but relaxes on the reverse stroke, reducing friction and conserving power.



TYPE B . . . This type of cup is essentially the same as Type A, except that the leading edge of the lip is square instead of beveled. This construction provides greater strength where the lip may be exposed to distortion or excessive wear due to openings in cylinder walls.

Johns-Manville Moulded Packing Cups can help you improve piston designs. They provide a highly efficient seal . . . improve equipment performance . . . lower operating and maintenance costs. These custom-made packings are extensively used on all types of slow moving pistons and rams operating under high or low pressures and temperatures.

Johns-Manville Moulded Packing Cups may be used on practically all air or hydraulic-operated cylinders. For instance, those which are in such equipment as reciprocating pumps, hydraulic jacks and presses, pneumatic chucks, governors, lift trucks, grease guns, valves, drilling and boring machinery . . . or on any other equipment where efficient piston design is essential.

You have your choice of a number of styles and compositions of these precision-moulded cups to meet temperatures and pressures encountered in hydraulically operated equipment. Types "A" and "B," shown here, are most widely used on inside-packed pistons with the outside edge or lip contacting the cylinder wall or liner. Other types are available, however, for other services.

If you would like more information on these or other types of Johns-Manville Custom-Made Piston Packings, get in touch with your Johns-Manville Packings Distributor, or write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

Fill in No. 12 on Reader Service Card

Why Pay a HIGH PRICE for PISTON RINGS in SHORT RUNS

AUTO-DIESEL Sell at ATTRACTIVE PRICES

It is no longer necessary to pay a high price for piston rings in small quantities. Hundreds of firms have been buying AUTO-DIESEL Piston Rings for years in short runs and at ATTRACTIVE PRICES. In addition, with our set up we can give fast service. We have specialized in this type of business since 1921 and are especially qualified for this type of work. Can make up to 35" diameter for original equipment and for replacement in compressors, hydraulic cylinders, valves, etc. Will make circular parts to your specifications. Write for prices.

Reduce DOWN-TIME with AUTO-DIESEL SCRAPER RINGS AN 6231..1 to 71

Down time is expensive. It means loss of production and always results in expensive repairs. AUTO-DIESEL Bronze Scraper Rings assure longer life of components used with pistons. They are LONG-WEARING because they are made right by skilled workers with years of experience. Can supply in sizes from ⅛" to 13" I.D. We also make rings and circular parts for jet engines. Have Auto-Diesel Engineers help you with any piston ring problem. Write today.

Write for Details

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH

The New

CAPITAL HYDRAULIC OIL FILTER

WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

SAE Reports

Continued

with diester added) have been selected for further evaluation.

The new hydrolytic stability test seems to provide important information on some of the characteristics of the new fluids when exposed to water in the hydraulic system. Surface tension of these fluids, being less than that of older fluids, may give rise to added leakage trouble. Tests at WADC show that line filters used with these fluids tend to clog more rapidly. Mock-up tests on both pumps and cylinders are being made at WADC.

A Walter Kidde representative raised the question as to what could be expected if the new fluids were suddenly exposed to high pressure air, a possibility in hydraulic systems with a pneumatic standby system. Comments indicated that the reaction would depend on a number of factors—air temperature, contact time and the rate of pressure rise in the system. A Douglas, Santa Monica representative reported that this company was testing this type of phenomena and might be able to report results at the next meeting.

A representative of WADC reported on work on high temperature packings in the Materials Laboratory and stated that two reports were available to qualified companies: WADC Technical Report 54-318, "Development of a Rubber for High Temperature Service in Contact with Experimental Hydraulic Fluids" and WADC Technical Report 54-458, "Development of a Rubber for Service in Contact with Experimental Hydraulic Fluids at 400 F". The first is a polyacrylate material, the second a neoprene type material.

At present, the neoprene type rubber appears acceptable for high temperature service. Buna N rubber is definitely in trouble at 275 F.

A North American, Downey, representative remarked that packings were lagging behind the development of high temperature fluids and components. Elasotomeric materials reform or mold at high temperatures; when subsequent operation at low temperature is attempted, considerable leakage occurs as a result of the high temperature set. Teflon is of little or no help unless adequately backed up. Spiral metal or other metal types may be helpful.

Packings and Gaskets, MIL-P-5516: A WADC representative reports they are still working on the spiral failure investigation; he estimated a final report can be made in about 12 months. BuAer is continuing to have success with the "D" seal. A panel with the Pantex representative as chairman was appointed to attempt to resolve the age control requirements for this spec. The panel's report, in which they made six recommendations, including a new accumulated age schedule, was accepted.

Chairman E. N. Cunningham reported that his "O" ring panel's scope had been broadened to include seals of all types and reviewed their current efforts.

Hydraulic System Optimum Pres-

Protects hydraulic circuits

ACTUAL SIZE

Denison Surge Damping Valve prevents hydraulic shock... eliminates damage to fittings, lines, seals and equipment

Sudden starting, sudden release of high pressure into a low pressure area, or reversal of flow causes a hydraulic surge as damaging to a circuit as blows from a hammer.

The Denison Surge Damping Valve converts the hydraulic surge into a smooth, gradually accelerated flow of fluid power. A hydraulically unbalanced reaction flow control in the valve causes the valve to open slower as the intensity of the surge increases.

Lightweight and easy to install, the Denison Surge Valve can be used on any circuit up to 5000 psi. Requires no adjustment . . . interferes in no way with the efficiency of the circuit.

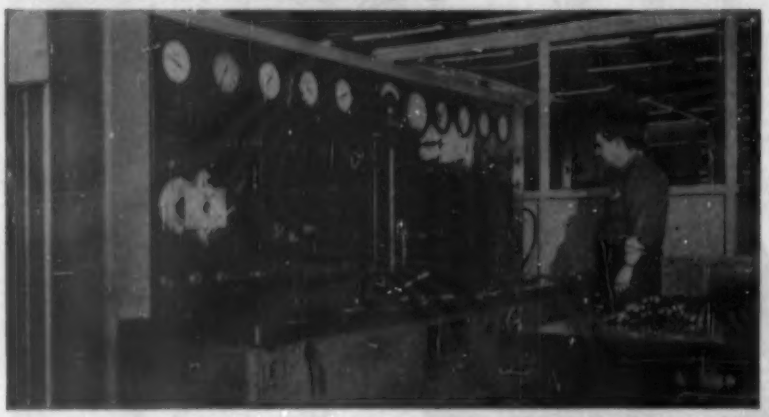
The circuit shows a Denison Surge Damping Valve preventing hydraulic shock when stored-up energy in an accumulator is released. For a bulletin on the surge valve, write to: THE DENISON ENGINEERING COMPANY, 1166 Dublin Road, Columbus 16, Ohio.

PUMPS • CONTROLS
MOTORS • PRESSES

DENISON
Hydr OIL ics

GREER TOPICS

Important News of Aviation & Industrial Test Equipment



Greer Stationary Hydraulic Accessories Test Stand, shown here in Ford's Kansas City Aircraft plant, provides a shop type machine to fully check hydraulic system accessories including system pump at flow rates up to 20gpm and at pressures up to 3400psi.

Greer Dual Hose Tester, used for B-47 hose lines, checks from one to six hose lines or similar production components with pressures to 25,000psi in covered burst chamber.

How Greer Helps Ford

Greer Test Machines check complex B-47 components at Ford's Kansas City plant

The Ford Motor Company's entire history is one of quality products, economically produced. One of the reasons for Ford's extraordinary record has been its high standard of quality control.

To help maintain these high standards in the manufacture of aircraft components, Greer test equipment is at work in Ford's Kansas City aircraft plant. Complex B-47 components are put through rigorous inspection to determine their air-worthiness.

Walk into virtually any plant in the aircraft industry and you'll find Greer equipment at work. Most of the units are standard equipment ordered directly out of a catalog (yours on request). Other units were specially built to out-of-ordinary specifications by the famous Greer engineering department. These men are ready to go to work for you.

Greer Portable Hydraulic Test Machine provides hydraulic test fluid for checking hydraulic systems of modern aircraft. Handles flows up to 20 gpm and pressures up to 3400psi.

GREER
TEST EQUIPMENT

Greer Hydraulics Inc., International Airport, Jamaica 30, New York

Field Offices: 1902 West Cermak Road, Chicago Illinois • 25 South Main Street, Dayton, Ohio
2932 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities

SAE Reports

Continued

sure Determinations: One of the highlights of the A-6 meeting was the report of Conrad H. Cooke of the Glenn L. Martin Co. digesting the findings published in the WADC Technical Report 54-189, Volumes I and II, "Theoretical Investigation of Optimum Pressures In Aircraft Hydraulic Systems". The general conclusions reached in the study were: (1) Not considering initial cost, the indicated optimum pressure is 4000 psi; (2) total effective gain in proceeding from 3000 to 4000 psi would be an effective system weight saving of 2.46 percent; (3) the theoretical optimum pressure is fairly independent of the type, size and proportions of hydraulic systems; (4) a tremendous initial, non-recurring, cost would be required to make the change from 3000 to 4000 psi; (5) a temporary loss in reliability will occur in the transition period; and (6) in the opinion of the contractor investigators, the small gain of 2.46 percent effective reduction in system weight does not justify the initial cost and temporary loss of reliability in changing the standard system pressure.

At the request of the chairman both Grumman and Douglas, Santa Monica, members prepared written comments on the Cooke report. The Grumman member pointed out that they were interested in the lightest airplane, not the lightest hydraulic system which averaged only 2 percent of the total aircraft weight and that reliability is of paramount importance. He also pointed out that less, not more, standardization in aircraft components is to be expected during the next ten years. The Douglas member agreed that the findings made a very good case for 3000 psi operating systems but disagreed that the theoretical optimum pressure is fairly independent of the type, size and proportions of the hydraulic systems. He also demonstrated that for very high horsepower systems it would be possible to realize weight savings of approximately 20 percent by changing from 3000 to 4500 psi operating pressure. He concluded that in such systems, careful consideration be given to the advantage of the higher pressure hydraulic system.

Filters, Line Type, Hydraulic, MS-28720: The North American member stated that the installation space of this filter was excessively large and that a better method was necessary for servicing the filter as to require less space. The –6 size has been the worse offender. The committee agreed to a change in clearance dimension and a recommendation to the Services to redesign the –6 size filter.

Filters, Hydraulic, MIL-F-5504: Bu-Aer reported that evaluation tests on the two direction flow reservoir elements were still in progress. A representative stated that major improvements have been made in AN 6235 and AN 6236 filters.

Accumulators, Aircraft Hydraulic Pressure, MIL-A-5498: The Republic

Extruded to finished dimensions!

Mullins Koldflo can mass produce steel parts like these with close tolerances . . . smooth surfaces . . . at lower cost

SPECIFICATIONS OF TYPICAL KOLDFLO EXTRUSION
Tractor power steering cylinder, length 16⅝ in. Diameter 2.813 in., held to −.000 + .002 in. Surface finish 60 microinches or better.

THESE one-piece parts are cold-extruded to precision dimensions, with no machining, grinding, or honing required. Thus, in volume quantities, the Mullins Koldflo* process can produce at far lower cost than other methods.

Mullins Koldflo permits you to design intricate cylindrical parts the way you want them. Design features such as shoulders, recesses, studs, etc., can usually be provided easily.

*Trade Mark

Let us quote on *your* parts . . . simply give us design details and specifications, and your quantity requirements.

Write or call the nearest Mullins office for engineering information. For copy of new booklet "How would you tool-up to make an egg?", write Koldflo Division, Mullins Manufacturing Corporation, Dept. B-12, Warren, Ohio.

Koldflo
DIVISION
MULLINS MANUFACTURING CORPORATION
Warren, Ohio

DISTRICT SALES ENGINEERING OFFICES

New York
500 Fifth Avenue
Phone—Pennsylvania 6-2773

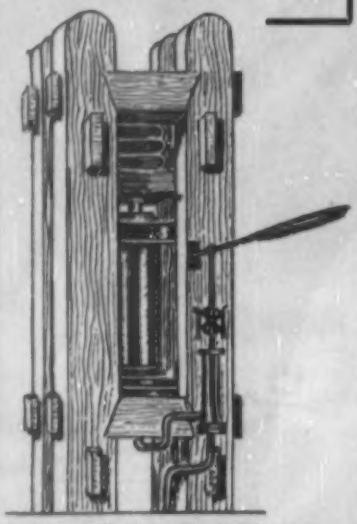
Detroit
18268 James Couzens Highway
Phone—Diamond 1-1490

Chicago
332 South Michigan Avenue
Phone—Harrison 7-3725

Phone—2-1166

Fill in No. 47 on Reader Service Card

THE FIRST HYDRAULIC PRESS WAS A BRITISH INVENTION BY JOSEPH BRAMAH, AND THE FORERUNNER OF ALL HYDRAULIC PRESSURE MACHINES



BRAMAH PRESS 1795

The HYDRAULIC ASSOCIATION of Great Britain

94/98 Petty France, London, S.W. 1 England

SAE Reports

Continued

member, on the basis of replies received to his questionnaire on self-displacing accumulators, recommended that no detailed spec or envelope be prepared at present, suggesting review in about one year.

Reservoirs, Hydraulic, MIL-R-5520: A WADC representative asked if a burst pressure requirement should be included in this spec since a proof pressure requirement is included. The Hughes member pointed out that surge pressures can be obtained in closed systems. The committee agreed that no burst pressure requirement should be added. The WADC representative reported work progressing on methods of replenishing airless reservoirs. A ground reservoir complete with hose, a coupling to match the airplane connection and a hand pump capable of 100 psi is required. The Greer representative suggested that equipment used to service some cabin superchargers would do the job.

Valve, Relief, Hydraulic Pressure, MIL-V-5523: The Douglas, El Segundo member pointed out that the Relief Valve Subcommittee of A-6 and members of AIA had agreed on the elimination of power pump cracking pressure in MIL-V-5523B but that when the spec was issued by the Services the cracking pressure had been retained. This imposes a penalty on relief valve designers in that with crack specified as it is, no less than 91 percent of rated flow pressure, a unit having a crack reseat flow pressure closer together than the ratio of 91 percent to 82 percent will not meet the spec, even though its reseat to rated flow performance is acceptable. The Adel member agreed. Considerable discussion ensued. Most of the aircraft engineers felt that such a crack pressure test requirement was not necessary. The tolerance to be permitted on full flow pressure and reseat pressure was also discussed. The tolerance now specified is apparently not enough to take care of the variations that exist in test stand equipment and imposes a hardship by causing the rejection of satisfactory valves. The final agreement was that pressure at full flow should be a maximum value and the pressure at reseat should be a minimum value.

A number of other items including a proposed spec on a hydraulic restrictor valve, shock mounting of pressure gages, corrosion resistant materials and hydraulic nomenclature were also discussed.

The chairman announced that the next meeting of A-6 will be at Hotel Monte Royale, Montreal, Canada, April 27, 28 and 29.

HYDRAULIC TEST STANDS...

To YOUR Specifications

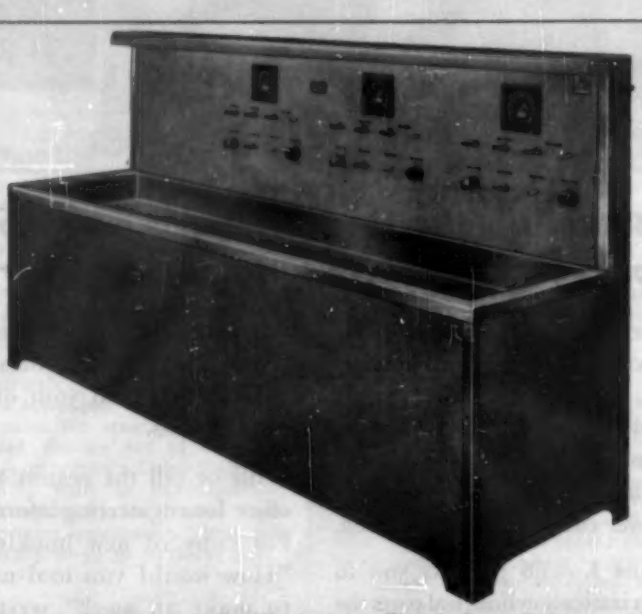


*Illustration Shows Test Stand Manufactured For Westinghouse Electric Corp., Baltimore, Md.

CARDWELL MACHINE COMPANY

Quality A CARDWELL TRADITION SINCE 1829

Franklin at 19th St. • Richmond 11, Virginia • Phone 7-2985

STOP HYDRAULIC OIL FIRES

Use Non-flammable HOUGHTO-SAFE

get this 4-way safety!

- Snuffer-type—non-flammable
- High Lubricity assures safety against wear
- Non-toxic
- Won't attack packings

Houghto-Safe . . . rated "Acceptable From The Fire Hazard Standpoint" by Factory Mutual Laboratories . . . is safe all around. Ask the Houghton Man for proof of its benefits that far outweigh its low cost. Or get it from E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

HOUGHTO-SAFE
. . . a product of

E F HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

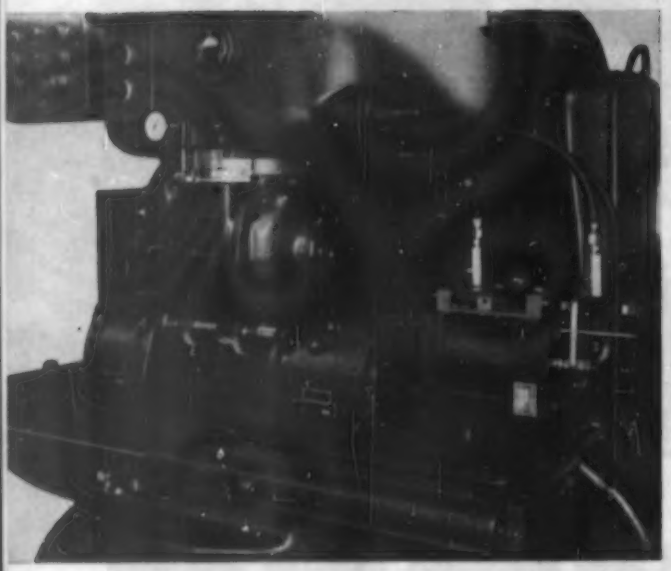


FIG. 1. TWO AIR CYLINDERS are used to provide semi-automatic loading of this gear shaver. The long stroke cylinder in front opens and closes a splash guard which has been removed to show the air cylinder that controls the tailstock.

AIR OPERATED DEVICES

speed machine loading

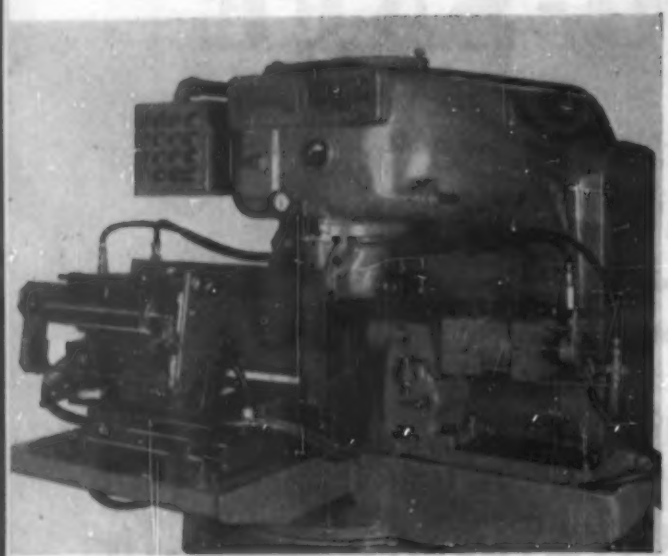


FIG. 2. FULL AUTOMATIC LOADING of longshaft unsymmetrical gears is provided by this air powered slide type device. This view with the splash guard removed shows the tailstock control cylinder. A similar cylinder controls the head stock.

DEVELOPMENT of many machine tools has progressed to the point where the actual machining time is less than the time it takes to manually load and unload the work. Because of this, machine designers are spending time and effort to provide automatic loaders which will greatly reduce the non-productive operation.

The gear shavers, built by National Broach and Machine Company, Detroit, are typical of those machine tools on which a short machine cycle has created the need for faster loading devices. On one of these gear shavers, for example, a twelve tooth gear, 1 inch in diameter and having 1 inch face width can be finished in eleven seconds. Manual loading and unloading takes about the same time. To reduce this part handling time, National Broach engineers have designed two different loading systems; both are powered by air cylinders. One is semi-automatic to reduce manual operations from seven to three; the other is automatic which requires only two simple manual operations.

To manually load a shaving machine, here's what an operator must do: 1. Place the gear in mesh with the shaving cutter, 2. Advance and lock the tailstock, 3. Close the splash guard door, 4. Press the start

button (The machine goes through its cycle), 5. Open the splash guard door, 6. Retract the tailstock, 7. Remove the gear.

SEMI-AUTOMATIC LOADING

Application of two air cylinders provides the semi-automatic loading device shown in Figure 1. One air cylinder controls the operation of the splash guard door and the other cylinder controls the tailstock for clamping the work between centers. With this loading arrangement, the operator only has to rest the gear on an approximate locator and in mesh with the cutter. He then presses a start button. From this point air power, controlled electrically, takes over. The splash door closes and the tailstock advances. The machine goes through its cycle during which the work is fed back and forth across the face of the cutter while being simultaneously fed to depth. After the cutter motor stops and the coolant is shut off, a delay switch causes the door to open first and then the tailstock retracts. The operator then removes the finished gear. The air circuit for this semi-automatic device is very simple. Direction of each cylinder is controlled by separate two position, 4-way double solenoid valves. Speed control valves are located in both the head and rod end lines of each cylinder to permit speed regulation on opening or closing.

AUTOMATIC LOADING

Using the automatic loading device which is pictured in Figure 2, the operator just keeps the magazine full and removes finished gears. There is no downtime between shaving operations on successive gears. The operator's hands are never near the cutter.

One of the automatic loading devices is the slide type loader. Its operation is illustrated in Figure 3. Specially designed to handle unsymmetrical gears with integral long shafts, the loader also includes a gaging device which permits only gears of correct tooth size to be loaded into the loader magazine.

As shown in Figure 3, the integral air cylinder in the loader

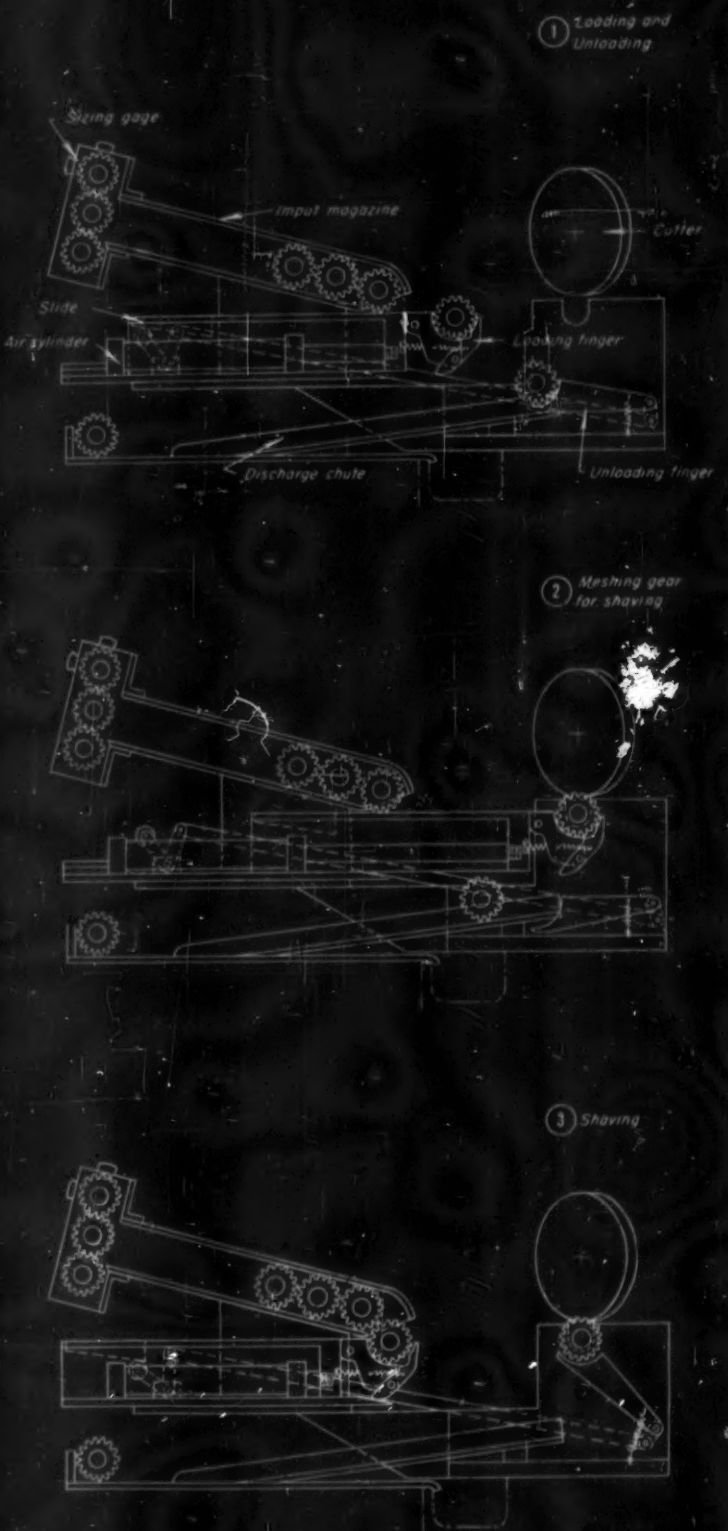


FIG. 3. SEQUENCE of operation for the slide type loader is illustrated in these sketches.

FLEX-O-TUBE®

If pressure is a factor in the performance of your product, you can rely on Flex-O-Tube. For here is a name that has stood for uniformity of high quality for twenty-five years.

And just as important, the Flex-O-Tube organization is one that you can rely on, too. When the pressure's on for production you can count on prompt deliveries of flexible hose products that consistently meet specifications.

These are but two of the reasons why industry has used miles and miles of Flex-O-Tube and continues to specify it in increasing quantities. Why don't you find out for yourself by "putting the pressure on Flex-O-Tube"?

Supplied in Assemblies

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

Name .....

Company .....

City ..... Zone ..... State .....

Address .....

FLEX-O-TUBE

DIVISION OF MERIDAN CORP.

2527 JIM DALY ROAD • INKSTER, MICHIGAN

Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

AIR OPERATED DEVICES

moves a slide forward. The loading finger picks up a gear from the input magazine and positions it in mesh with the cutter and in line with the head and tailstocks. The shaving machine functions are tied in with the loading functions in such a manner that air cylinders on either or both head and tailstocks can then advance to hold the gear.

When the shaving cycle is completed, the tailstock and headstock retracts and the unloading finger in the loader deposits the finish-shaved gear in the discharge chute where it rolls to a position in front of the operator.

The loader in Figure 2 handles a gear with centers in each end and has air cylinders controlling both head and tailstock advance. Unique design features in the loader, include a device that assures the gear passing through the gaging gears in square relation and fingers in both input magazine and discharge chute that pass gears from position-to-position in both chutes without cocking. These fingers also prevent the gears from touching each other and damaging accurate tooth surfaces.

An air cylinder controlled rack and pinion type device automatically controls a roller steadyrest that is raised to support the long shaft gear during the shaving operation.

Here's the sequence of operation for automatic loader: With a shaving cycle completed and the finish shaved gear unloaded, the lower cylinder in the loader advances the slide to position a gear in mesh with the cutter. The headstock advances first and then the tailstock advances thus clamping the work on centers. Next the air cylinder at the rear of the loaders causes the roller steadyrest to raise and contact the shaft of the gear at midpoint.

The slide is retracted, the coolant is turned on and the shaving cycle is initiated. Following the shaving operation, the steadyrest is retracted, the tail and headstocks retract and the machine cycle is completed.

With the automatic device, loading and unloading time takes 2 seconds as compared to 10 seconds for manual loading and unloading. The air powered automatic system doubles production.

THE VALVE THAT REVOLUTIONIZED AIR CYLINDER OPERATION

You are looking at a cut-away section of the air control valve that has made air cylinder history—the Bellows Electroaire Valve. It, as much as any single factor, has been responsible for the terrific growth in the use of pneumatic circuits in production processes in the past ten years.

Why? - First of all — it is a complete air control unit. Not only does it direct the high pressure air to the desired cylinder port *instantly, without lag,* but it regulates and controls the speed of the air cylinder piston.

Second - while electrically controlled, it is not electrically powered. Instead of using heavy power solenoids to shift the valve, it uses the air it controls to do the work. Two sealed solenoids, hardly bigger than a thimble, act as "triggers" to release and direct the high pressure air.

Third - the small sealed solenoids act on only 8 volts of current. There is no danger of solenoid burnout (in fact the control units are guaranteed against burnout). Wiring requirements in interlocked circuits are simple. There is no electrical hazard to either operator or machine.

Fourth - the Electroaire Valve is compact. No bigger than a package of king-size cigarettes, it fits into crowded quarters, or on moving machines.

And finally — the Electroaire Valve is durable. Over a quarter of a million are in everyday use. Records of 30,000,000, 40,000,000 even 50,000,000 cycles without repairs of any kind are common.

Of course, the Electroaire Valve is a built-in feature of all electrically-controlled Bellows Air Motors, but it is equally suitable for use with any conventional air cylinder up to bores of 4½" - 5".

WRITE FOR THESE FREE BOOKLETS

Bulletins EV-310 — and CL-50 — detailed information on the Bellows Electroaire Valve and other Bellows "Controlled-Air-Power" Devices. Address:
The Bellows Co., Akron 9, Ohio
Dept. AH 1234

In Canada: Bellows Pneumatic Devices of Canada, Ltd.
4972 Dundas St., West, Toronto 18, Ontario

The Bellows Co.

AKRON 9, OHIO

918-A

CONTROLLED-AIR-POWER FOR FASTER, SAFER, BETTER PRODUCTION

Between sessions, J. T. Greenlee, VP, Imperial Brass Mfg. Co., who will be conference director next year, talks with C. L. Conroy, President, Anchor Coupling Company; and E. R. Backofen, Clark Equipment Company.

NCIH Holds Outstanding 10th ANNIVERSARY MEETING

THE 10th Anniversary meeting of the National Conference on Industrial Hydraulics, held on Thursday and Friday, October 14 and 15th at the Hotel Sheraton, Chicago, was an outstanding success with well over 600 registrants. It is estimated that with guests, visitors from the AIEE national meeting and other visitors, some of whom dropped in to hear one or two papers, at least seven hundred persons attended one or more of the Conference sessions. Conference Director Carl E. Schmitz, the Conference Committee and the staff headed by Conference secretary Chester A. Arents, are to be congratulated on the program and the fine manner in which it was presented.

As in several past years, the first morning was given over to a general technical session; the other technical sessions were given in the afternoon and on the morning and afternoon of the second day with three sessions being held simultaneously. Two papers were given at each session except the Fire Resistant Hydraulic Fluids session where only one formal paper was presented.

The Fire Resistant Hydraulic Fluids session was limited to one paper, an excellent survey "Effect of Hydraulic Fluids on Synthetic

Standing, Chairman R. Q. Sharpe, Socony Vacuum Oil Company, introduces the panel for session on hydraulic fluids. To his left is H. C. Crosland, technical director, Sirvene division, Chicago Rawhide Manufacturing Company, who presented paper "Effect of Hydraulic Fluids on Synthetic Rubber". Other panel members, left to right, are J. T. Bunting, Aluminum Company of America; F. L. Mackin, General Motors Institute; P. H. Lavely, Koppers Company, Inc.; Paul Berndt, Johnson Motors; Sharpe; Crosland, W. H. Millett, Carbide & Carbon Chemicals Company; J. S. Harris, Monsanto Chemical Company; J. K. Douglas, The Oilgear Company; and G. B. Miller, Racine Hydraulics and Machinery, Inc.

ONE OF A SERIES

You Get Many Benefits by Specifying VICKERS® Hydraulics

Factory Trained *Field Service Specialists* From Coast to Coast

All machinery made by man requires servicing at times. Every manufacturer has two responsibilities: First, to build his equipment in a way that will require the least amount of servicing. Second, to see to it that servicing, when needed, is handled with speed, efficiency and low cost.

Vickers hydraulic equipment is built to keep service requirements to an irreducible minimum. But when service is required, it is handled by Field Service Specialists working out of Vickers offices from coast to coast. These men have been carefully trained in Vickers plants and are thoroughly competent. They know how to adjust and maintain any piece of Vickers equipment . . . any combination of components. They are also qualified to instruct customers' service organizations in improving their hydraulic maintenance practices. These men devote their full time to servicing Vickers products in customers' plants. They do their job well and at minimum expense.

This is only one of many benefits you receive when you specify Vickers Hydraulics.

VICKERS
Incorporated
DIVISION OF THE SPERRY CORPORATION

1474 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices:
ATLANTA • CHICAGO AREA (Brookfield) • CINCINNATI CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • NEW YORK AREA (Summit, N. J.) PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Relaxing between sessions are (left to right) Ransom Tyler, The Oilgear Co., Julius Kendall, Greer Hydraulics., Inc., Pat Albergo, Barksdale Valves, Hubert J. Maisonneuve, Rousseau Controls, Ltd. and Ernest O. Gibson, Jr., Greer Hydraulics, Inc.

The "Big Wheels" of the Pump session. In the foreground are J. W. Broome, Raytheon Mfg. Co., Inc. (left) and R. H. Marvin, the Franklin Institute Laboratories for Research and Development, the speakers. J. L. Shearer of MIT (left rear) was a panel member and Ernst Weidmann, The Oilgear Co. was chairman.

Rubber" by H. C. Crosland, Technical Director, Sirvene Division, Chicago Rawhide Manufacturing Co. Under the chairmanship of R. Q. Sharpe, Staff Engineer, Lubrication Department, Socony Vacuum Oil Co., a large panel, composed of representative users and suppliers of fluids, pumps and packings, participated in a lively and informative discussion. In the user group were: W. N. Whitney, Superintendent of Engineering, Delco-Remy Division, General Motors Corp.; P. H. Lavely, Manager, Oven Machinery Branch, Koppers Company, Inc.; Paul Berndt, Manager, Die Casting Division, Johnson Motors; J. T. Bunting, Staff Mechanical Engineer, Aluminum Company of America and F. L. Mackin, Chairman, Machine and Wood Shops and Hydraulics, General Motors Institute. Pump manufacturers were represented by G. B. Miller, Chief Engineer, Racine Hydraulics and Machinery, Inc. and J. K. Douglas, Development Engineer, The Oilgear Company. Fluid specialists who participated were J. S. Harris, Supervisor, Functional Fluid Sales, Monsanto Chemical Co. and W. H. Millett, Technical Representative, Carbide & Carbon Chemicals Company. Because of the unusual interest and the value of the discussion, this discussion will be published in the Proceedings. (Editor's note: we expect to publish a rather extended edited version of this discussion in an early issue of APPLIED HYDRAULICS.)

Two subjects not represented by separate technical session in previous Conferences were included for

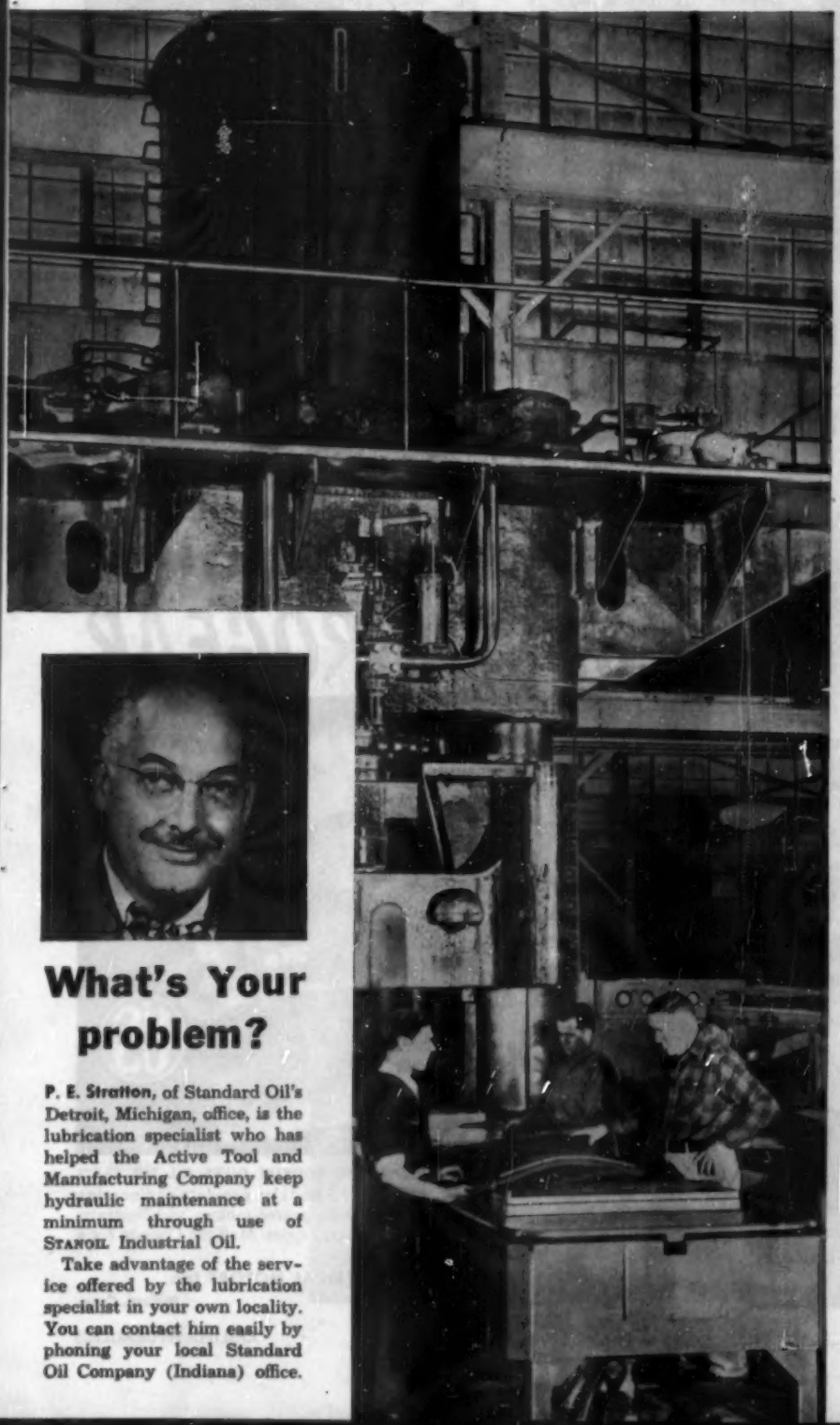
(Left to right) Don Morrell, Ford Motor Co., Ken Court, John Dietiker and Ed Gatwood of Vickers, Inc. stop for a chat.

G. T. Lyon, T. E. Lyon and G. S. Ellis of L & L Mfg. Co. and Jim Neff of Neff Engineering Co. enjoy a cigarett between sessions.

Fill in No. 91 on Reader Service Card

STANOIL
TRADE MARK
Industrial Oil

How they keep hydraulic maintenance to a minimum



What's Your problem?

P. E. Stratton, of Standard Oil's Detroit, Michigan, office, is the lubrication specialist who has helped the Active Tool and Manufacturing Company keep hydraulic maintenance at a minimum through use of STANOIL Industrial Oil.

Take advantage of the service offered by the lubrication specialist in your own locality. You can contact him easily by phoning your local Standard Oil Company (Indiana) office.

● Officials of the Active Tool and Manufacturing Company, Detroit, Michigan, count on trouble-free hydraulic operation of this giant press. They place much of their confidence in the performance of STANOIL Industrial Oil—and with good reason.

Recommended by a Standard Oil lubrication specialist, STANOIL has served in the hydraulic system of this press for over four years. In all of that time, it has not been necessary to replace the original fill of oil nor has the hydraulic system once needed to be cleaned. Periodic tests of oil samples have shown that STANOIL, despite hard service and high oil-operating temperatures, has maintained a lubricating quality comparable with new oil.

You, too, can rely on this unique, versatile oil to give you clean, dependable service, in a wide variety of equipment. The Standard Oil lubrication specialist serving your area of the Midwest will be glad to show you operating records covering the many applications of STANOIL. Phone him at your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

STANDARD

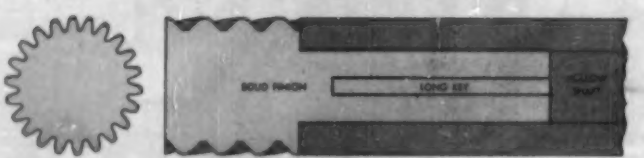
STANDARD OIL COMPANY

(Indiana)

In your opinion, which pinion?

. . . for longest life in a gearmotor

ORDINARY SHELL TYPE PINION



U. S. SOLID TYPE PINION

In an internally geared motor the pinion on the motor shaft is the vital link between motor and gearing. It's the fastest, but smallest gear, so it must be extra strong, free from vibration and forever tight. Now compare the U. S. Syncrogear motor pinion with the ordinary type. Note the extra large section area of the U. S. design. It has a long solid shank that anchors into the motor's hollow shaft, whereas the ordinary shell type has a small section area, short keyed.

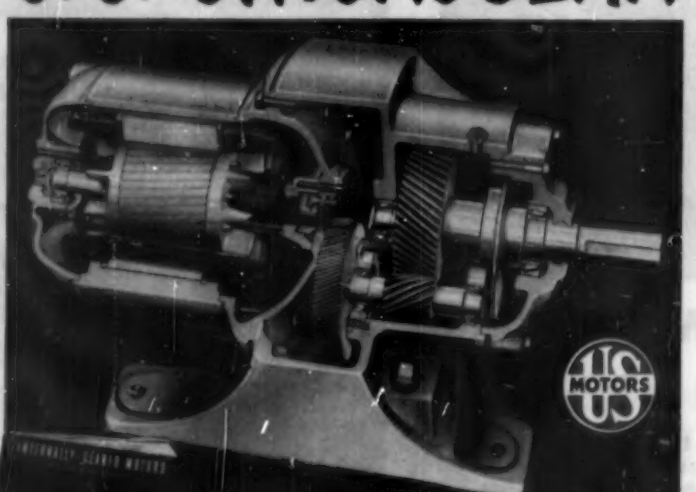
Obviously the U. S. design is most substantial, longer lasting, more resistant to deflection and can carry high speed loads far more safely than common designs. All the gears are deep-hardened and shaved to exact tolerances in the U. S. plants.

Added life lengthening features

The rugged pyramidal case supports the motor and gear train and all castings are normalized to insure permanent alignment and to prevent distortion. The motor windings are asbestos-protected to avoid carbonization and guard against burnouts. All moving parts are completely enclosed for weather and dust protection and confined within the least cubical dimensions on a single mounting. ¼ to 30 h.p.; 10 to 10,000 r.p.m.

THE ONLY MOTOR WITH A BUILT-IN PINION

U. S. SYNCROGEAR



AH-12

U. S. Electrical Motors Inc.
Box 2058, Los Angeles 54, Calif. or Milford, Conn.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

FREE 16-PAGE DESCRIPTIVE BOOKLET GIVES ALL THE FACTS
Interesting multi-colored Booklet presents engineering facts you should know about geared motors, and illustrates the various U. S. Syncrogear types. Mail the Coupon for a copy. No obligation.

U. S. ELECTRICAL MOTORS Inc.

Los Angeles 54, Calif. **Milford, Conn.**

the first time: Heat Dissipation and Pneumatic Controls.

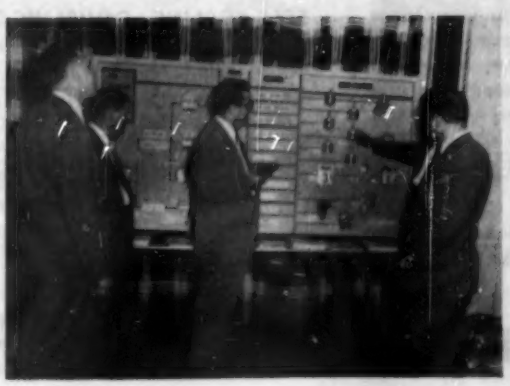
John C. Hanna, Vice President and Chief Engineer, Hanna Engineering Works, was chairman of the Heat Dissipation session. This session heard two different viewpoints on heat generation and dissipation in hydraulic circuits. J. K. Douglas, Development Engineer, The Oilgear Co. in his paper "Heat: Its Generation and Natural Dissipation in Hydraulic Circuits" represented the point of view of a pump manufacturer. D. W. Retzinger, Sales Engineer, Young Radiator Company, in his paper "Heat: Forced Convection Removal from Industrial Hydraulic Circuits" represented the view of the manufacturer of standard equipment to remove and control heat in hydraulic systems. The growing importance of the control of hydraulic fluid temperature to assure accuracy of control, longer component, fluid and packing service life and the reduction of downtime was emphatically pointed out by both papers.

Pneumatic Controls session, with R. R. Stevens, Sales Manager, Eastern Division, Westinghouse Air Brake Company as chairman, heard a basic design paper and product design paper. The basic design paper, "Development of Valves for the Control of Pneumatic Power" by S. Y. Lee and J. L. Shearer, Assistant Professors of Mechanical Engineering, Massachusetts Institute of Technology, was delivered by Professor Shearer. This was a significant paper because comparatively little work has been done in the development of pneumatic valves from a theoretical design point of view. The product design paper, "Compressed Air Processing for the Protection of Pneumatic Equipment" was delivered by D. G. Faust, Chief Engineer, C. A. Norgren Company.

The other six sessions: Machine Tools; Pumps; Presses; Lift Trucks; Automotive and Aircraft Controls heard leading authorities and enjoyed worthwhile panel discussions.

J. T. Greenlee, Vice President, Imperial Brass Manufacturing Co. was named as Conference Director for 1955.

David Mitchell of Fluid Controls and Frank Schindler of Fluid Regulators, listen while Don Stark of Fluid Controls goes over features of one of his valves with C. B. Prellsen of Joy Manufacturing Co.



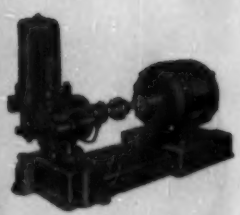
The Barksdale Valve exhibit drew a number of interested Conference registrants.

KRAISSL

● Since 1926 ● In the application, design and manufacture—pumps, separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps • Vacuum Powered Transmission and Low Pressure Air Service • Air and Liquid Filters



Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

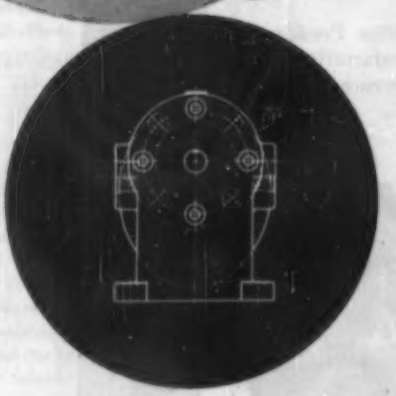
Write today for Bulletin A-1289, for air-cooled pumps—and for A-1523 for the water-cooled models.

KRAISSL KRAISSL CO

305 Williams Ave., Hackensack

Unlimited Mounting Possibilities

... with these pumps for pressures up to 500 psi



When mounting pumps, foot position may be varied in relation to ports at 90° stages through a complete circle.

You can meet practically any mounting requirement with pumps in the Brown & Sharpe 500 Series. Compact flanged stand and separate foot-type bracket make installation easy in any position ... allow quick adaptation for duplex and motor-drive units. Suction and discharge ports on both sides and ends of pumps facilitate piping. In addition, you get such top-performance features as quiet-running hardened gears, long-lived needle bearings and mechanical sealing ... for positive, trouble-free service. Write for New 70-page Pump Catalog 35P. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Brown & Sharpe

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

Continued from page 10

RELIEF VALVES . . . for critical applications in which failure to hold pressure is hazardous are featured in literature released by Fluid Controls, Inc. This new line of the differential piston type is simply constructed with a minimum of parts. The valve is fully described in a cross section drawing, shows a diagram illustrating its use in a typical circuit and charts list its operating features.

Fill in No. 157 on Reader Service Card

CYLINDRICAL ROLLER BEARINGS . . . are the subject of a new catalog, TR-854-C, issued by Rollway Bearing Company. It lists types, sizes, dimensions and load ratings. Detailed are crowned rollers, a feature which relieves high stress areas at the roller ends. A formula for load ratings and a method for calculating expected bearing life are included in this literature.

Fill in No. 158 on Reader Service Card

PRESSURE PLUGS . . . with fully formed threads for positive sealing are described in a new catalog. Prepared by Standard Pressed Steel Co., the 32 page brochure details the company's line of socket head screws, self-locking set screws and other precision threaded fasteners. The catalog shows photographs of all products listed, applications are indicated in line drawings and cut away drawings emphasize special features. An easy-to-read table details dimensions of each product and diagrams keyed to the specification tables simplify the measurement references.

Fill in No. 159 on Reader Service Card

SELF-SEALING COUPLINGS . . . for hydraulic pressure lines of up to 3000 psi are detailed in an eight page catalog issued by Dowty Hydraulic Units, Ltd. Graphs produced from figures obtained under actual working conditions show that these couplings have a minimum pressure loss. Sizes and installation data, and sectional drawings are given.

Fill in No. 160 on Reader Service Card

SILICONE RUBBER PARTS . . . made by advanced compounding techniques by Acushnet Process Company are discussed in a new 8 page brochure. It states the company has complete facilities to mix their

own stocks to meet each customers particular specifications and requirements. Using versatile silicone gums the company formulates their own compound to arrive at the specific property needed for each individual application. The catalog outlines general properties, advanced molding techniques, mold design and design specifications. It describes and illustrates O-rings, gaskets, boots, insulators, bonded and miscellaneous parts, and shows a variety of interesting applications. A brief description of the company's facilities and laboratories completes the booklet.

Fill in No. 161 on Reader Service Card

HYDRO-PNEUMATIC ACCUMULATOR . . . that will cushion shock and vibration is described in Bulletin 1100, available from Greer Hydraulics, Inc. The complete assembly consists of a steel alloy shell, a synthetic compound separator bag incorporating an integrally molded air valve, and an oil port assembly. This component is especially recommended for mobile applications, and the brochure shows a typical accumulator installation on a fork truck and its operation.

Fill in No. 162 on Reader Service Card

TUBE FITTINGS . . . A comprehensive 76 page catalog, 4300, published by The Parker Appliance Company, lists steel, brass, stainless steel, aluminum leakproof tube fittings and tube fabricating equipment.

UNBRAKO

dryseal-thread

PRESSURE PLUGS

HOW THEY WORK

Internal Root Crushes External Crest Here

External Root Crushes Internal Crest Here

In tightening of UNBRAKO Pressure Plugs, the roots of the flattened threads actually crush the sharper crests of the mating parts. Major and minor diameters are positively sealed, pressure tight without compound. Stocked and sold by leading industrial distributors everywhere. Write for literature. STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION

SPS

JENKINTOWN PENNSYLVANIA

Fill in No. 92 on Reader Service Card

FREE

THE ONLY

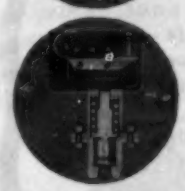
COMPLETE HANDBOOK

ON PRESSURE & VACUUM SWITCHES

As an aid in planning the vital link between your electric and hydraulic circuits, this manual contains a glossary of terms and a schematic demonstration of operating characteristics. Functions and methods are described in detail and liberally clarified with diagrams and illustrations, including symbols for circuit detailing and specification purposes. To provide the means for proper selection of a pressure switch for your specific application, a simple step by step selection chart has been developed helping you to organize your requirements in their relative order. Finally a complete run-down, illustration and tabulation of all the detail features leading to the unit that answers your specific control problem. You couldn't buy a comparable handbook.

FOR EXTREME ACCURACY,
Diaphragm and Bourdon Tube Switches
Vacuum to 12,000 P.S.I.

FOR EXTREMELY LONG LIFE,
Piston Switches, Low Settings — High Proof Pressures to 15,000 P.S.I.



FOR HAZARDOUS LOCATIONS
Explosion-Proof Models

ALL SWITCHES operate in any position, are not sensitive to vibration.

BARKSDALE VALVES

PRESSURE SWITCH DIVISION

5125 Alcoa Avenue, Los Angeles 58, California

Please send a copy of the above described *Free* handbook 4M.

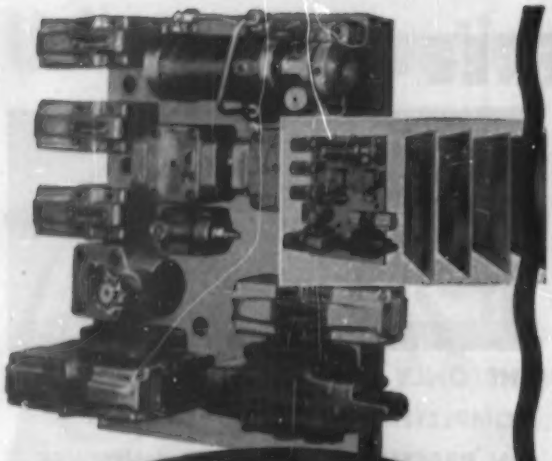
NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Fill in No. 14 on Reader Service Card



ALMO

HYDRAULIC
CONTROL MANIFOLDS

SIMPLIFY MACHINE DESIGN
ELIMINATE COSTLY PIPING

Leading machine manufacturers use these manifolds to cut costs and obtain permanent trouble-free operation. Send your hydraulic circuit print and sketch showing desired take-off connections. We'll prepare a manifold proposal—No obligation.

ALMO TOOL COMPANY
11470 Koltz—Centerline, Mich.

"Design Wise"

Colonial Broach Co. uses an Almo manifold in this 15 ton capacity, 66" stroke dual-ram broaching machine.

Fill in No. 8 on Reader Service Card

USEFUL LITERATURE

Beautifully illustrated, the catalog is divided into several parts, presenting 3-piece flare fittings, flareless fittings, pipe fittings, tube cutters and others. Each section is fully illustrated, giving complete specifications and engineering data of components described. The catalog includes tube bending and flaring instructions, tubing selection data and recommendations for wall thickness of tubing for various pressures and types of service.

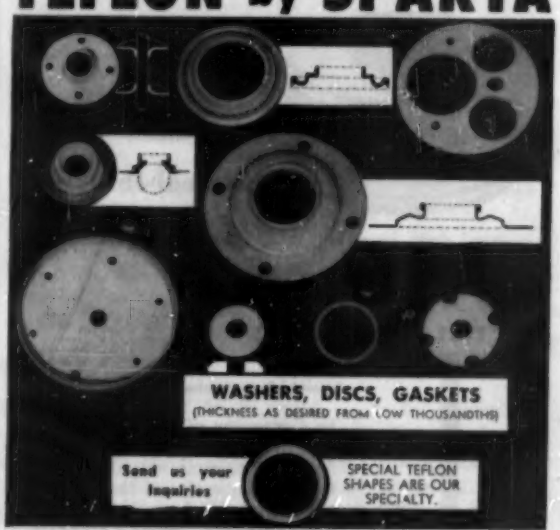
Fill in No. 163 on Reader Service Card

"FIX THAT TROUBLE" . . . is the title of a four page brochure published by Worthington Corporation showing in cartoon form how to locate troubles in air-cooled and water-cooled air compressors. It tells what may be wrong if a compressor overheats, fails to deliver air, insufficient capacity, if compressor vibrates, or compressor overloads motor and other troubles.

Fill in No. 164 on Reader Service Card

PUMPS, VALVES . . . and complete power packages manufactured by Simplex Engineering Co., are the subject of a new bulletin G. The pumps, of the LA Series, are fixed displacement radial piston pumps built on an improved design which enables them to

TEFLON by SPARTA


WASHERS, DISCS, GASKETS
(THICKNESS AS DESIRED FROM LOW THOUSANDTHS)
Send us your inquiries
SPECIAL TEFLON SHAPES ARE OUR SPECIALTY.

If you have a problem concerning sealing, non-friction, non-adhesion, chemical inertness, temperature, electrical or other . . . that one or more of the remarkable combinations of properties of TEFLON can help you solve, let us try to help.

SPARTA MANUFACTURING
Company • EAST SPARTA, OHIO

Fill in No. 89 on Reader Service Card

generate pressures as high as 10,000 psi without loss of mechanical efficiency. The pump is well illustrated showing all construction parts and its principle of operation. Safety relief valves, high pressure 4-way valve, high pressure check valve and pilot operated check valve are also described, sizes and pressure ranges tabulated. Power packages shown in this brochure are suitable for a wide range of hydraulic power requirements.

Fill in No. 165 on Reader Service Card

HYDRAULIC VALVES . . . for high pressure, large press applications requiring accumulator station control are featured in literature issued by Lombard Corporation. All valve bodies are of forged carbon steel for the standard valves for normal service. The catalog gives complete engineering data, diagram drawings and sizes of throttle and shut-off valves, filling valves and control valves. Special valves and accumulator controls are also detailed.

Fill in No. 166 on Reader Service Card

PLUG VALVE ACTUATOR . . . for the remote control of all types and sizes of wrench-operated plug valves from 1 inch to 8 inches is described in an eight-page illustrated bulletin published by The Pantex Manufacturing Corporation. The company manufactures the complete unit, cylinder and actuator. It comes completely assembled ready to attach to pipe and plug

Fill in No. 71 on Reader Service Card

Fast-Rugged-Dependable
AV AIR CONTROL VALVES
3-WAY..4-WAY PILOT OPERATED VALVES
Short operating stroke gives exceptionally high speed performance.
Uses small, low-power, nationally-known solenoids.
Small, compact, made with non-corrosive materials. 3-way (norm. open or closed) and 4-way operation full port sizes ¼", ⅜", ½" and ¾".
3-WAY... 4-WAY SOLENOID OPERATED PILOT VALVES
Direct acting—¼" pipe tap for pressures to 150 P.S.I.
Light aluminum construction.
Operates master valves, or small cylinders up to 3" in diameter.
SPEED CONTROL VALVE
Efficiently controls speed of piston rod of cylinder. Restricts air being exhausted from cylinder.
Used on air or hydraulics —pressures to 1200 P.S.I.
Sizes ¼", ⅜" ½" and ¾".
Write for bulletin and attractive O.E.M. and quantity discounts
AUTOMATIC VALVE CO.
37419 Grand River Ave.
FARMINGTON, MICHIGAN

Fill in No. 13 on Reader Service Card

CALCULATOR
for Air and Hydraulic Systems

If your job responsibility touches on mechanical actions for automation, you'll find this Lindberg combination air and hydraulic calculator handy to have around. It's in slide rule form and it will help you to make quick, easy determinations of the proper air or hydraulic circuit data. The calculator is free. No obligation. Just mail the coupon at the bottom of this ad.

Why LINDBERG CYLINDERS for your application?

It makes sense to specify Lindberg cylinders because you can depend on them. Originally made for use with Lindberg Furnaces, they have proved themselves through years of consistently good service in a wide variety of air and hydraulic applications. Check the coupon below for informative literature.

LINDBERG AIR & HYDRAULIC DIVISION
A DIVISION OF LINDBERG ENGINEERING COMPANY
225 N. Laflin Street, Chicago 7, Ill.

Please send me, free of charge, the following:
- ☐ Air & Hydraulic Cylinder Calculator
- ☐ Bulletin No. 800—Air and Hydraulic Cylinders
- ☐ Information on Large and Special Cylinders
- ☐ Name of nearest Cylinder Representative

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY & STATE _____

Fill in No. 56 on Reader Service Card

USEFUL LITERATURE

valve stem. These actuators are designed for pneumatic operation, but provision can be made for hydraulic operation on special order. The unit will operate in any position at operating pressures from 30 to 125 psi. The bulletin is illustrated with photographs of typical installations, detailed line drawings and gives complete engineering data.

Fill in No. 167 on Reader Service Card

PUSH TYPE QUICK COUPLERS . . . which employ the one hand connect and disconnect principle are covered in True Flate's, Inc., No. 4 catalog. Available in two body sizes with pipe threads from ⅛ to ½ inch, the coupler's working parts are of case hardened steel. This catalog also contains information on sleeve type ball locking couplers engineered to provide a maximum flow of air with minimum line pressure drop. All units are illustrated, diameter and thread sizes listed.

Fill in No. 168 on Reader Service Card

MEASURING AND CONTROL INSTRUMENTS . . . A new general 12 page catalog illustrates a complete line of process instrumentation available from Fischer & Porter Company. It gives basic specifications and descriptions of pressure and temperature instruments; density and specific gravity measuring instruments;

It's packed with ideas for product designers
. . . a completely new edition of the booklet

"APPLICATION IDEAS"
by
GAST

showing actual practical O.E.M. applications like this . . .

Get Your Free Copy Now!

For Gast rotary AIR MOTORS
. . . 1/20 to 4 h.p.
. . . 100 to 6,000 r.p.m.

COMPRESSORS
. . . up to 30 p.s.i.
. . . ⅓ to 24 c.f.m.

VACUUM PUMPS
. . . up to 28 in.
. . . ⅓ to 24 c.f.m.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY — AIR MOTORS · COMPRESSORS · VACUUM PUMPS (TO 4 H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Mobley St., Benton Harbor, Mich.

Fill in No. 38 on Reader Service Card

liquid level instruments; electric, pneumatic, and electronic transmitting, recording and controlling instruments with alarms and integrators. Also featured are air-operated control valves in various models and construction materials. One section of the catalog is devoted to centralized control panels, data reduction and automation systems, and other instrumentation packages.

Fill in No. 169 on Reader Service Card

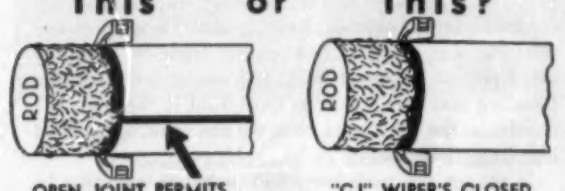
PACKING SELECTOR SLIDERULE . . . which will pick out the right packing for almost any application is offered by New York Belting and Packing Co. The selector, a cardboard disc six inches in diameter shows packing styles, pressure and temperature reading for the four types of packing applications, gaskets, valve stems, centrifugal and reciprocating pumps. The material being handled is printed alongside a window in a second and smaller disc mounted on the larger one. The reverse side of the wheel gives the sizes in which the recommended packing is available.

Fill in No. 170 on Reader Service Card

HYDRAULIC TRACER . . . for general machine tool applications is explained and illustrated in a folder released by True-Trace Corp. Model a-3D is a precision stylus operated multiple hydraulic servo valve which controls the flow of oil to and from each end of three hydraulic cylinders, two of which are mounted hori-

For Industrial Use—

This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For those dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint
(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use the 3 Piece FALL WIPER RING FWR-3C**

Spec. MIL-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) and endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Co., Toledo 1, Ohio

Phone Adams 4513

Fall Wiper Ring SPRING LOADED

Covered by patents issued and patents pending.

ELECTRO SNAP

Exclusive—

SIMPLIFIED CONTROLS

One-Way Impulse Switch

MODEL 654—KM2

ELIMINATES INTERLOCKING SWITCHES AND COMPLICATED ACTUATING DOGS

This exclusive switch is ideal for pulsing solenoid valves on air-hydraulic controls, sequencing circuits, etc., because it allows other controls to reverse or operate the same circuit. It sends a short electrical impulse and then switches itself out of the circuit.

GIVES MORE DEPENDABLE CONTROL

Switch replaces timers, relays, and troublesome one-way dogs to simplify circuits—cuts chances for failure. No delicate adjustments.

LOWERS COST OF CONTROL CIRCUITS

Impulse switch costs less than complicated control devices it replaces. Fewer switches are required for sequencing. Because of simplicity, maintenance is easy.

SPEEDS UP AUTOMATIC OPERATION

Automatic machines can run faster because cycles can be more closely sequenced. There's no delay due to timer tolerances or extra machine motions to actuate interlock switches.

TRY IT NOW—WRITE FOR BULLETIN ESF-12

SPECIFICATIONS

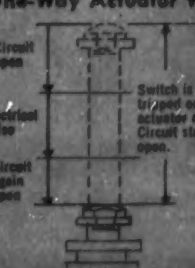
rated at 10 amps., 125/250 v. AC.

Movement differential 0.02".

Operating Force 3½ lbs.

Four models available with over-travel and pulsing strokes from 1/16" to 5/16".

How Exclusive One-Way Actuator Works



ELECTRO-SNAP SWITCH & MFG. COMPANY

4224 West Lake Street, Chicago 24, Illinois

PALMETTO®
G-T®
RING

Perfect for the WATSON-STILLMAN "Lab" Press

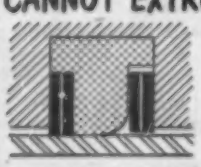
Widely used Watson-Stillman Laboratory Presses, with capacities from 10 to 100 tons, operate at a maximum pressure of 6,050 psi. Conventional packings, because of extrusion, had to be replaced in 4 to 7 days; the G-T Ring, in the same application—as a dynamic ram seal—lasted from 3 to 4 months without extruding!

That's why Watson-Stillman switched to the G-T Ring—and switched for good!

CANNOT SPIRAL . . .

The Palmetto G-T Ring, unlike an O-Ring, will not twist and turn in the groove. T-form prevents spiral failure even in dynamic applications.

CANNOT EXTRUDE . . .



Resilient "T"-section supported by non-extrusion rings on either side makes extrusion impossible. As pressure is applied, non-extrusion rings are urged against cylinder wall, blocking the path of extrusion.

Write for our Manual MP-200, Engineering Standards for Palmetto Molded Packings. For design information on G-T Rings, see our catalog in Sweet's Product Design File.

PALMETTO Packings

packing more performance into every application

GREENE, TWEED & CO. North Wales, Pa.

USEFUL LITERATURE

zontally with piston rods at 90 degrees to each other, the third of which is mounted perpendicular to the plane of the other two cylinders. Design, operation and special features of the unit are fully described.

Fill in No. 171 on Reader Service Card

HAND AND FOOT OPERATED VALVES . . . of Ross Operating Valve Company's 600 and 880 series are featured in their new bulletin 303-B. Described are many design advancements of three- and four-way hand operated and three- and four-way foot operated valves. The bulletin details installation data; parts lists and exploded views of the valves show the assembly relationship between parts. Colored air flow diagrams for the three- and four-way valves are also provided.

Fill in No. 172 on Reader Service Card

Low Pressure Bleeding

Concluded from page 55

course from the reservoir, into the return port of the master cylinder, through the selector valve, through the replenish valve, out to and through the park valve, right out to the bleed port (10) at the wheel.

We see also that the reservoir is pressurized by air from the engine, which is received in the air storage tank (11) at around 100 psi, and is regulated to 10 psi, (12), and delivered to the reservoir. So, maintaining the brake in the attitude shown, and while air pressure exists in the reservoir, we merely need to open the bleed port to bleed off fluid, and air, at low pressure. Bleeding may then continue until fluid in the reservoir recedes to the refill level, then we can refill, and repeat bleeding, if necessary.

If we set the park lever half way, air will also be bled from the park valve. During the bleeding process, the pedal should be pressed briefly to clear the pressure line, then released and the flow through the return allowed to continue. It will be noted that in this process we are reversing the usual direction of flow in the return line.

The process can be used without operating the aircraft system, in this case we would supply pressure to the pressure line by means of a test stand, and apply shop air to the air storage tank, which would be controlled by the air regulator.

Finally, we can check the condition of bleed in the system at any time, provided air is in the air storage tank and the reservoir, down to say 2 or 3 psi, by merely opening the bleed valve and noting any emission of air.

The low pressure bleeding method has proved effective in the aircraft system. We have seen some of the reasons why this is so. Operators who experience difficulty in bleeding any hydraulic system should certainly try this method, it will almost always prove more effective than a high pressure method.

LOOK

RIVETT OFFERS *NEW*

Series 6600
Solenoid Pilot Operated.
Furnished in 1/2", 3/4", 1" 1-1/4" and 1-1/2" I.P.S.

gasket-mounted hydraulic valves

4-way 3000 p.s.i.

Designed and Built to J.I.C. Standards

Advanced features offer you broader opportunity for control

Series 6500
Direct Solenoid Operated.
Furnished in 1/4" I.P.S.

1. Greater flow capacity. (Ex: 6600 series ⅜" size rated at 28 G.P.M. at 15 ft. per sec.)
2. Less pressure drop.
3. More compact in size.
4. Seven spool designs for 3 and 4-way control.
5. Dust sealed and moisture resistant. Roomy wiring box.
6. Continuous duty, shock mounted solenoids. 3.6 amps inrush and .45 amps holding at 115 V.
7. Shock resistant spool. Scalloped design and metering grooves eliminate impact.
8. All surfaces precision ground.
9. May be mounted in any position.
10. High tensile, nickel alloy body.

RIVETT LATHE & GRINDER, Inc.
Brighton 35, Boston, Mass.

COMPARE and PROVE!
Get new Catalog—

shows *why* new Rivett gasket-mounted solenoid pilot valves are best; illustrates flow operations for all piston designs. This book is a must on every board—easy to understand, it will simplify your valving problems. Write today!

Rivett Lathe & Grinder, Inc., Dept. AH-12
Brighton 35, Boston, Mass.
Please send free Catalog 260.

Name_____

Company_____

City_____ State_____

RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS

Air and Hydraulic • All sizes and types

Designed and engineered with the user in mind, O-M Cylinders embody every essential construction and mechanical feature to assure trouble-free performance and long service.

They are built of steel with bearing surfaces of bronze—precision machined with modern equipment.

Cylinder bores are honed to a fine finish, and the hi-tensile piston rods are polished to give long life and smooth performance.

Effective O-ring static seals are backed up to prevent extrusion under high pressures. All packings are self-adjusting and are carefully selected for proper usage.

A rigid inspection at the factory is your guarantee of peak performance.

O-M Cylinders fit where others won't because O-M special interlocking mechanism eliminates bulging tie rods and end caps.

Available in a full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. *14-day delivery on most sizes.*

Write today for FREE catalog and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

MAIL COUPON NOW!

ORTMAN-MILLER MACHINE CO.
1143rd Street - Hammond, Ind.

☐ Please have representative call
☐ Please send latest catalog

Name _____
Company _____
Address _____
City _____ Zone ____ State _____

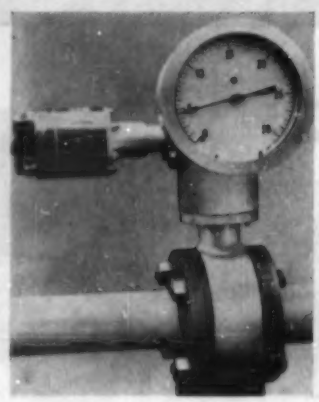
NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

Continued from page 18

FLOW-RATE METER
. . . mounts in any position

Design: Unit consists of meter body, replaceable meter range insert, packless friction-free seal, mounting yoke, 6 inch dial indicator and pressure differential adjustment screw. On the yoke is provided a mounting pad for accessories such as micro-switches, pneumatic or electrical position transmitters, or local controllers.



Features: Flowmeter combines the in-line installation simplicity and economy of the differential orifice with the linear measurement signal. The pressure drop at any given setting is essentially constant throughout the flow range.

Sizes: Available for installation in pipe lines from ½ inch to 12 inches to cover flow rates from 0.2 to 2,000 gpm.

Devicengineering Company
Philadelphia, Pa.

Fill in No. 118 on Reader Service Card

LUBRICANT DISPENSER
. . . is oil powered

Features: Hydraulically operated valve for dispensing predetermined, measured quantities of lubricant. Valve incorporates an adjusting screw at each end of the measuring chamber for controlling the exact quantity of lubricant output desired. Valve is designed for use with a four-way control valve which is supplied with lubricant from a power operated pump.

Applications: Provides means for automatically applying metered quantities of oil or grease to gear cases, bearings, electric motors, and in assembly line operations.

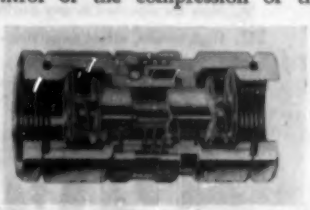
Lincoln Engineering Company
Industrial Division
St. Louis, Mo.

Fill in No. 119 on Reader Service Card

QUICK CONNECT—DISCONNECT COUPLINGS
. . . for high pressure applications

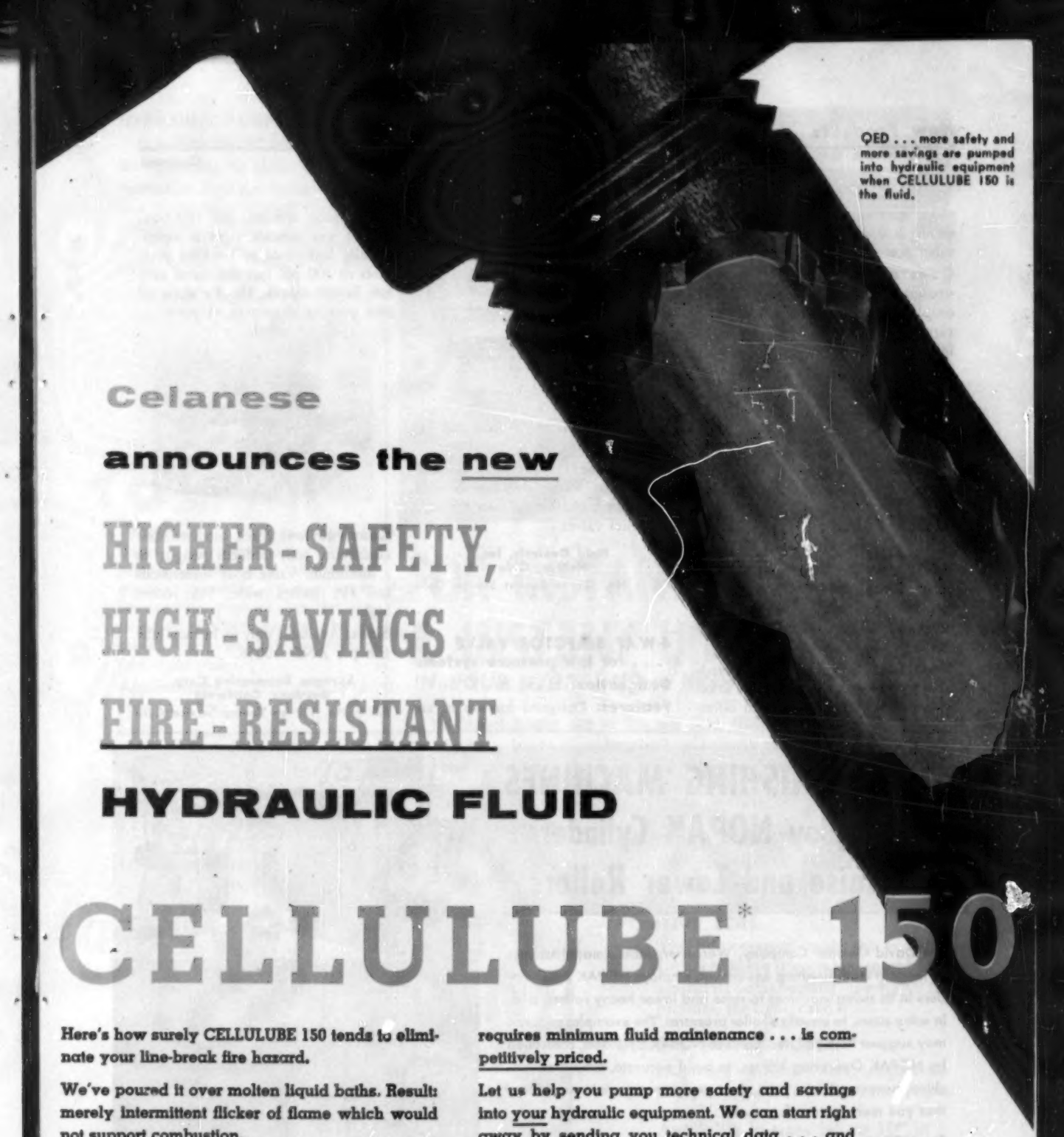
Designation: "H" Series

Design: Metal to metal valve stop in closed position permits positive control of the compression of the valve washer sealing member regardless of the surge or pressure build-up in the line. New type barrel spring, with a perforated "spider", full circle



Fill in No. 69 on Reader Service Card

Fill in No. 24 on Reader Service Card



QED . . . more safety and more savings are pumped into hydraulic equipment when CELLULUBE 150 is the fluid.

Celanese

announces the new

HIGHER-SAFETY, HIGH-SAVINGS FIRE-RESISTANT HYDRAULIC FLUID

CELLULUBE* 150

Here's how surely CELLULUBE 150 tends to eliminate your line-break fire hazard.

We've poured it over molten liquid baths. Result: merely intermittent flicker of flame which would not support combustion.

We've atomized CELLULUBE 150 onto hot metal flame-heated to approximately twice the temperature at which petroleum based fluids spontaneously ignite. There was no ignition with CELLULUBE 150.

In addition to providing such outstanding fire resistance, CELLULUBE 150 assures excellent lubrication . . . is non-corrosive, non-reactive, chemically stable, long-lasting . . . contains no additives . . . has a high boiling point (approx. 790° F.) . . . requires minimum fluid maintenance . . . is competitively priced.

Let us help you pump more safety and savings into your hydraulic equipment. We can start right away by sending you technical data . . . and supplying answers to your specific hydraulic fluid problems. Your request will get prompt attention.

Celanese Corporation of America,
Chemical Division, Dept. 588-L
180 Madison Avenue, New York 16, N. Y.

Celanese* CHEMICALS

*Reg. U.S. Pat. Off.

valve stop and guide, holds valves steady in open position, allowing no valve float.

Construction: High tensile strength alloy steel is used, but the couplings can also be made in a variety of stainless steels and non-ferrous materials to meet unusual conditions.

Sizes: Available in ⅛ to 10 inches inside diameter.

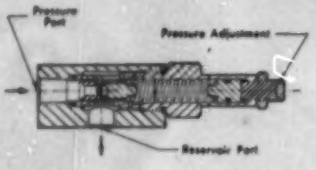
Snap-Tite, Inc.
Union City, Pa.

Fill in No. 120 on Reader Service Card

RELIEF VALVE
. . . for clamping circuits

Features: Working parts of this spring loaded, guided piston type relief valve are made from hardened steel and ground or honed to fine finish and close tolerance.

Specifications: Models are available in standard, screw or hand knob pressure adjustment, in seven different pressure ranges. These extend from the lowest of 10 to 30 psi to the highest from 200 to 600 psi.



Sizes: Available in ¼ inch and ⅜ inch.

Applications: Particularly suitable for circuits where pressure is controlled by a continuous flow through the relief valves.

Fluid Controls, Inc.
Mentor, Ohio

Fill in No. 121 on Reader Service Card

4-WAY SELECTOR VALVE
. . . for low pressure systems

Designation: Model No. S-576

Features: Designed for use in air or hydraulic systems, this two-position, 4 way selector valve is exceptionally leak-proof at working pressures to 100 psi, and maintains very low handle torque. Handle stops assure positive alignment of ports.

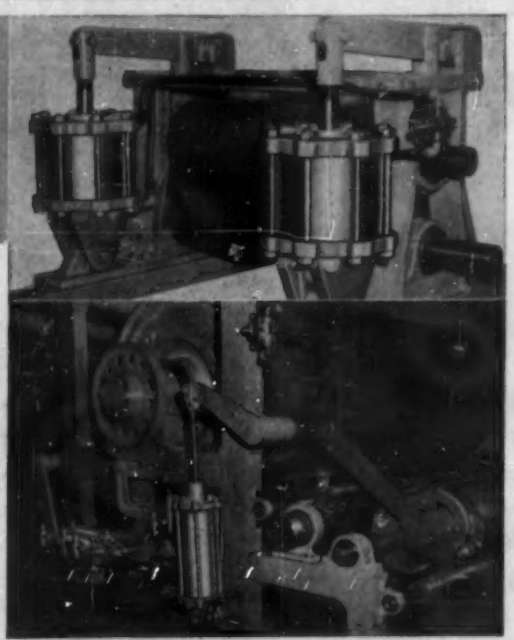
Construction: Black anodized, cast aluminum body reduces weight to a minimum. Valve body dimensions are 2½ inches wide, 1⅝ inches high.

Sizes: Available only in ¼ inch tube size per AND 10056.

Sprague Engineering Corp.
Gardena, California

Fill in No. 122 on Reader Service Card

CLOTH-FINISHING MACHINES
. . . employ NOPAK Cylinders
to Raise and Lower Rollers



The David Gessner Company, Worcester, Mass., manufacturers of modern cloth finishing equipment, employs NOPAK Air Cylinders in its sizing machines to raise and lower heavy rollers, and, in some cases, to equalize roller pressures. The examples pictured may suggest how you, too, can use NOPAK Cylinders, controlled by NOPAK Operating Valves, to build accurate, simplified machine movements into your plant equipment, or into machinery that you manufacture for resale.

The NOPAK Application Manual shows you how NOPAK Valves and Cylinders are being used in all types of industry, in many types of machinery and equipment for pulling, pushing, lifting, lowering, clamping, positioning. If you haven't seen a copy, ask your NOPAK representative, or write.

GALLAND-HENNING NOPAK DIVISION
2743 SOUTH 31ST STREET • MILWAUKEE 46, WISCONSIN
Write for Bulletin SW-2
Representatives in Principal Cities

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

A 7996-½-HA

Fill in No. 37 on Reader Service Card

HYDRAULIC PUMP
. . . develops up to 60,000 psi

Designation: Air Hydro Pump

Features: Produces hydraulic pressure by means of a small volume of compressed air. This model has a ratio of 690 to 1 and will produce hydraulic pressure of 60,000 psi, with

100 psi air. The pump automatically comes to rest when the desired pressure is reached, holds this pressure without consuming more air. Any intermediate pressure can be obtained by a simple turn of the air control valve, which is an integral part of the pump.

Application: For high pressure hydrostatic testing.

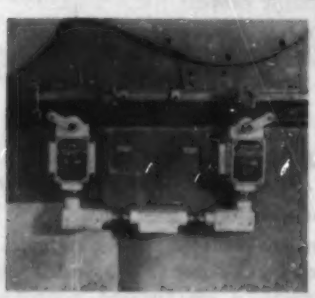
Davies Brothers
New York, N. Y.

Fill in No. 123 on Reader Service Card

LIMIT SWITCH
. . . provides 70 degrees overtravel

Designation: Loxswitch Series L100

Design: Incorporates a new trigger-type mechanism with only four rotating parts. The greater margin of overtravel is accomplished without the use of cams, levers or extra springs.

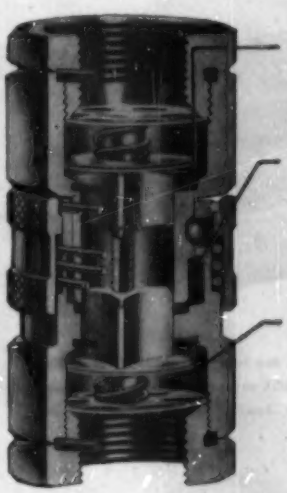


70 degrees overtravel is provided in either direction of the lever.

Feature: Overtravel's purpose is to facilitate faster installation by pro-

FOR INSTANT COUPLING & INSTANT UNCOUPLING
IN YOUR HYDRAULIC or HIGH PRESSURE SYSTEM

The Smallest Coupling, Size for Size, with Higher Efficiency and Highest Strength
The large inside diameter—with its recessed valve washers, fluted valve stems, and valve stops with minimum flow restrictions, combine to allow maximum flow capacity.



MINIMUM MAINTENANCE
The valve washers, which are under controlled compression, last indefinitely.

POSITIVE SEAL
The line pressure inside the *exclusive* U-Packer keeps it open and forced back against its metal backing—the *higher* the pressure, the *tighter* the seal!

RESISTS HEAVY SURGE
Snap-tite's full-circle valve-stops resist heavy line surge. The valves *cannot* float.

Available in sizes ⅛" to 10" in alloy steel or to specification.

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

See the Snap-tite representative in your city, or write

Snap-tite, INC.
UNION CITY, PENNSYLVANIA

Fill in No. 86 on Reader Service Card

Fill in No. 60 on Reader Service Card

Up to 60% Silver Brazing Savings with
NEW
LM
EDGEWOUND
WASHERS

NOW SILVER BRAZING WASHERS SNAP OFF COIL PREPLACE ON WORK

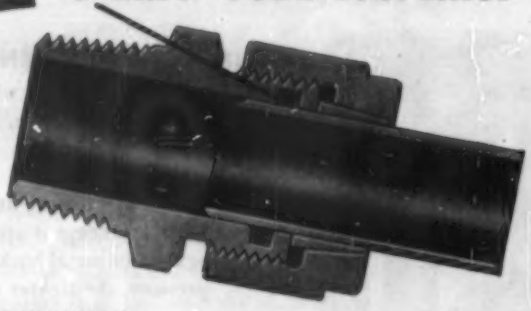
★ Produced from standard wire stocks. No lead time needed for dies or exact strip.
★ Suitable for use with induction, gas-air, furnace, or any of the commonly used heating methods.
★ Available in EASY FLO and SILFOS as well as Copper, Bronze and other alloys.
★ Diameters up to 4" I.D., wire thicknesses from .010 upward.

FREE 10 page booklet gives you all the facts on better brazing with preforms. Write Today!

LUCAS-MILHAUPT ENGINEERING CO.
5052 S. LAKE DRIVE, CUDAHY, WISCONSIN

LENZ "O-RING" TUBE COUPLINGS

ELIMINATES
FLARING,
THREADING,
WELDING,
SOLDERING



A HACKSAW AND FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. Nut fits loosely on the tube for ease of assembly. The higher the pressure the tighter the grip. LENZ FITTINGS are ideal for quick, simple, easy to assemble, leak-proof connection — for steel or copper tubing — on air and hydraulic systems.

DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

LENZ COMPANY
Box 1044-A • Dayton 1, Ohio • ME 2557—MR 7985

New Products

Continued

viding an additional safety factor, and greater protection against switch breakage and damage.

Applications: For automating machine tools and conveyors.

R. B. Denison Mfg. Co.
Cleveland, Ohio

Fill in No. 124 on Reader Service Card

SOLENOID VALVE
. . . for low pressure shut-off

Designation: Valcor U-3900

Features: Self-lapping and self-cleaning, the valve has a 100 per cent efficient seal in both directions. Straight-through flow, it has an absolute minimum pressure drop. The

valve weighs only 33 pounds.

Specifications: Operating voltage —18-30 V.D.C.; Current drain—½ amp @ 24 V.D.C.; Maximum operating pressure—100 psi; Porting—AND 10050-4. Other port sizes available either normally open or normally closed.

Valcor Engineering Corporation
Kenilworth, New Jersey

Fill in No. 125 on Reader Service Card

QUICK-CONNECT COUPLING
. . . handles large volume of air

Designation: Series 3-RL

Design: Equipped with an automatic sleeve lock, this one-way shut-off coupling is quickly and positively connected by pushing the plug into the socket. A locking ring in the socket, which is forced into a groove in the plug when coupling is con-

Fill in No. 55 on Reader Service Card

Fill in No. 72 on Reader Service Card

Now...

more hydraulic work

than ever before!

Pantex

¾" Pilot Operated 4-Way Valve
Solenoid Controlled
100-5,000 p. s. i.

This wide-range Pantex Valve offers many unusual operating features, for instance:

Hollow Type Spool
gives true open-center valve, provides *through-flow passage* to tank port when spool is centered and both cylinder ports blocked,

Tandem Operation
possible with two or more valves and with only one "out" and "in" tank line used,

Simple, Compact, Economical
installation and operation made possible by single conduit connection; less inrush amperage; and replaceable cartridge-type solenoid coils—

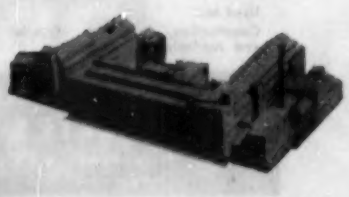
. . . plus other features of fast response, low leakage and choice of six spool types make this valve an unusually effective unit for present or contemplated hydraulic control applications.

Also available—

Relief Valves
350 — 5,000 p.s.i.

¼" Directly Operated 4-Way Valve
Solenoid Controlled
100-5,000 p.s.i.

¾" Pilot Operated 4-Way Valve
Remotely Controlled
100 — 5,000 p.s.i.



. . . hydraulic control specialists . . .

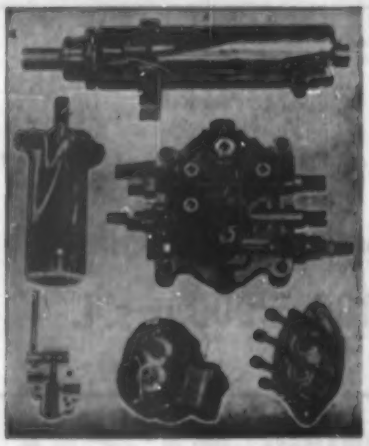
Pantex

MANUFACTURING - CORPORATION
PAWTUCKET, RHODE ISLAND

since 1927

HUSCO®

PUMPS
VALVES
CYLINDERS



"Husco" manufactures many standard and special hydraulic control units which include:

Hydraulic Cylinders—all types
Control Valves—capacities to 30 GPM—3000 PSI
Lever Operated Check Valves
Reciprocating Valves
Rotating Swivels
Check Valves
Package Power Units

"HUSCO" CUSTOM BUILT HYDRAULIC CYLINDERS

Complete lines of single-acting and double-acting cylinders, differential type, as well as telescoping cylinders, are available. All cylinders are built to customer application requirements. "HUSCO" cylinders are:

(1) Designed to insure concentricity of guides which are piloted from the same diameter

(2) Adequately guided to prevent any bearing load against the packings—insuring full life of packings and safe-guarding against leakage

(3) Provided with an adjust nut for take up on the packings

"HUSCO" welcomes the opportunity to provide engineering assistance on hydraulic problems and in developing new hydraulic equipment

Used on:
Construction, Industrial, Material Handling and Agricultural Equipment

HYDRAULIC UNIT SPECIALTIES CO.
Pumps • Valves • Cylinders
Waukesha, Wis.

New Products

Continued

nected, provides practically 360 degrees metal-to-metal contact, reduces wear and insures tight fit.

Construction: Sockets are brass with steel sleeves, plugs are steel.

Sockets for use with small hand operated air tools are available in aluminum.

Applications: Will handle any air line and many other fluid line applications requiring ⅛ to ¾ inch connections.

The Hansen Manufacturing Co.
Cleveland, Ohio

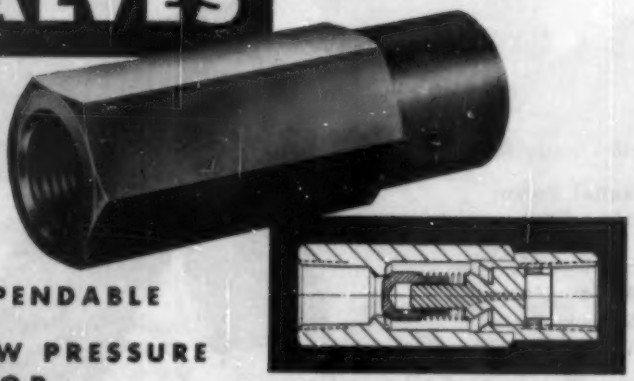
Fill in No. 126 on Reader Service Card

PACKAGED POWER UNIT . . . for special machines

Application: Package illustrated is for a special machine that drills, taps and mills hydraulic steering housing. It includes powering a fluid motor,

which feeds and turns a tapping head. The unit feeds a milling head, clamps the part and operates a positioning cylinder which in turn re-

CHECK VALVES



■ DEPENDABLE
■ LOW PRESSURE DROP
■ LOW COST
■ FOR OIL

• For Oil
• Copper Brazed Steel Bodies
• To 3000 P.S.I. Service
• Pipe Sizes ¼", ⅜", ½", ¾"

Write or phone Mentor, Ohio, Blackburn 5-2625 for complete specifications.

Fluid Controls, inc.

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

locates the part of the tapping, after the drilling operation.

Construction: Vane pumps rated at 2000 psi; two 2 hp electric motors; solenoid directional valves; compensated flow controls; pressure controls and check valves; fittings and tubing, and 40 gallon reservoir.

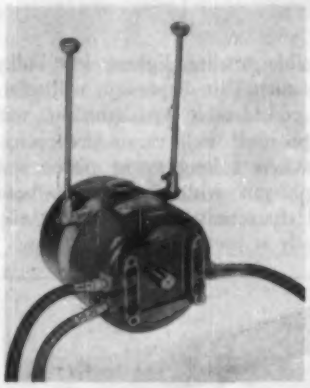
J. N. Fauver Company, Inc.
Hydraulic Division,
Detroit, Mich.

Fill in No. 127 on Reader Service Card

HYDRAULIC POWER UNIT . . . is complete control package

Designation: Hi-Lo-Pac

Design: This self contained unit provides a hydraulic pump, oil reservoir, pressure relief valve, filter and two control valves. It's designed for



direct drive from a tractor PTO shaft.

Specifications: Delivery up to 12 gpm, up to 10 hp; 2½ gallon oil reservoir; cartridge type pressure relief valve factory set at 1,000 psi; easily cleaned enclosed brass screen filter; drive from 200-600 rpm, two control valves for control of either single-acting or double-acting systems individually or simultaneously.

Char-Lynn Company
Minneapolis, Minn.

Fill in No. 128 on Reader Service Card

4-WAY CONTROL VALVE . . . has built-in adjustable relief valve

Designation: Model 1260

Features: A 3 position valve with open center spool, spring return to neutral. The spool is hardened, ground and chrome plated. The handle can be mounted in any of four positions.

Applications: For operating hydraulic loaders, dumps, industrial hy-

your leather packings are only as good as the leather they're made from

That's why Rhoads Packings are made from premium Tannate leather. Tannate is a special tanned leather, developed for industrial applications exclusively. It's a flexible leather, which means it can be formed with a minimum of strain, and yet retain a higher proportion of the leather's natural strength. Because of this extra strength Tannate will withstand the highest pressures to which any packing can be subjected with a minimum of cold flow or extrusion. Tannate leather is a non-abrasive material, therefore these packings will not score or abrade cylinder walls or pistons. Impregnated to meet your requirements, Tannate leather packings become adaptable to a wide range of operating conditions . . . they can be made hard as rock or soft and flexible.

Tannate packings are precision molded and finished to provide an effective seal against glycerin, alcohol, mineral, fish and animal oils . . . water, vegetable or any other non-caustic, non-acid fluid. For more specific information write J. E. Rhoads and Sons, 35 North 6th Street, Phila. 6, Pa.

RHOADS
INDUSTRIAL LEATHERS
PHILADELPHIA • NEW YORK • CHICAGO • ATLANTA

Fill in No. 79 on Reader Service Card

Continued

draulic equipment, farm tractor implements. Can also be used as a single

unit or mounted in series for multiple control situations on all types of hydraulically actuated equipment.

Specifications: Relief valves are factory set at 1000 psi, but are adjustable from 750 to 1500 psi.

Dukes Company, Inc.
Chicago, Ill.

Fill in No. 129 on Reader Service Card

HAND TUBE CUTTER
. . . with burring blade

Designation: Model 216A

Features: Cutter is rugged, adjustable for tubing ranging from ⅛ to 1 inch outside diameter. It produces clean, squarely cut ends on steel and stainless steel tubing, also on softer

copper, brass and aluminum alloy tubing. Ball handle feeds cutting wheel with even pressure as cutter is rotated around tube. The burring blade is recessed in the handle.

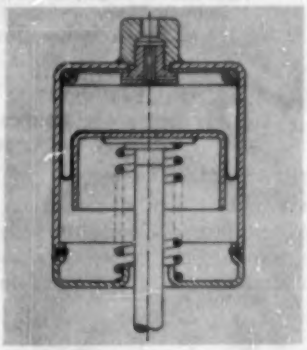
The Parker Appliance Company
Cleveland, Ohio

Fill in No. 130 on Reader Service Card

FLUID POWER ACTUATOR
. . . with diaphragm seal

Designation: "Class 2"

Design: Bead type seal design, and wall thickness of only .050 inch make



possible smaller, lighter, less bulky actuators. This diaphragm will tolerate considerable misalignment, will adapt itself well to rough applications. As a long stroke piston seal diaphragm with the O-ring bead seal characteristics, it functions efficiently at pressures up to 500 psi.

REPUBLIC
"LO-TORQ"
SELECTOR VALVE

0-6000 psi SERVICE with
LOW TURNING TORQUE

Exceptionally low turning torque is obtained by "floating" the valving disk in the service fluid, thereby balancing the pressure and eliminating thrust bearings . . . a sound application of the hydraulic engineering principle that fluids under pressure exert force equally in all directions.

Sealing rings on both sides of the selector disk eliminate leakage at all times whether pressure is forward, back, or off entirely.

For air and gas service, 0-1000 and 0-3000 psi; for fuel, hydraulic oil, petroleum, and water service, sizes ⅛" to 1", 0-2000 and 0-6000 psi. 2, 3, and 4-way.

Write for catalog no. 454 for complete information.

Distributors in principal cities from coast to coast.

- 0-6000 psi service
- Low turning torque
- Panel mounting
- Semi-steel, bronze, aluminum alloy
- No leakage at any time
- 3 types of portings

RM

REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

Fill in No. 78 on Reader Service Card

Applications: For all air and hydraulic applications falling within the limits of the diaphragm stroke.

Bellofram Corporation
Waltham, Mass.

Fill in No. 131 on Reader Service Card

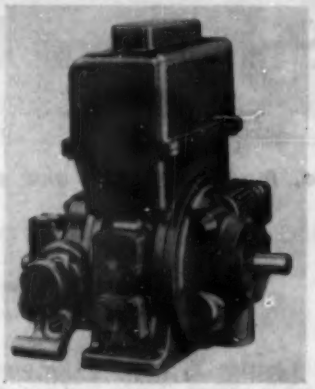
VARIABLE DELIVERY PUMP . . . for feed applications

Designation: Type JK-10602 and JK-10604

Design: These compact packaged units are identical in design, construction and principle of operation to earlier models of the feed pumps. However, the variable delivery radial piston pumps in the new feed pumps are over four times larger in capacity, yet the mounting and overall unit dimensions are identical to the earlier designs.

Features: Dual, direct solenoid actuated, built-in control valves provide quick and positive control functions in response to remote pushbutton or limit switch control. Inspection, adjustment and servicing of practically all parts can be performed without removing pump, disconnecting piping or draining the system.

Specifications: At drive speed of 860 rpm Type JK-10602 has maxi-



mum feed of 465 cipm at 1000 psi, rapid traverse of 1570 cipm at 300 psi; Type JK-10604 has maximum feed of 465 cipm at 1000 psi, rapid traverse of 2480 cipm at 300 psi.

The Oilgear Company
Milwaukee, Wis.

Fill in No. 132 on Reader Service Card

MOISTURE SEPARATOR . . . for air lines

Designation: Series 150

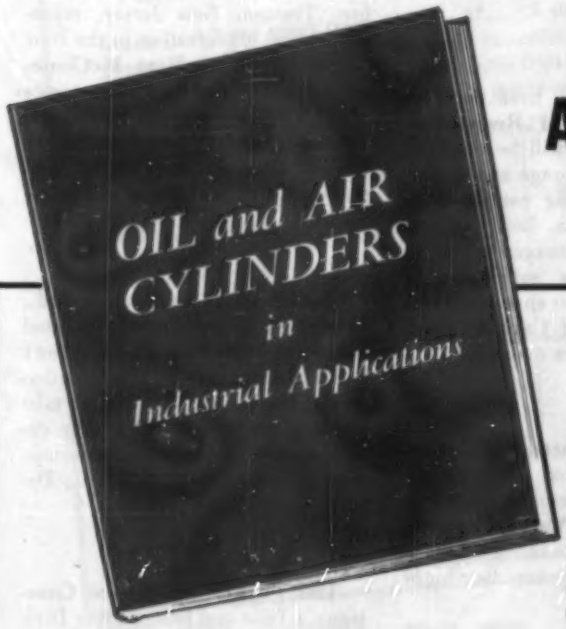
Feature: Designed for either continuous or intermittent flow lines, the units operate without pressure drop and with no flutter. Because the float triggers the moisture discharge rather than actually opening and closing the port, the unit gives high efficiency. A built-in filter screen pro-

tects operating parts against rust and grit.

Sizes: Available for ¼ to 3 inch lines. Operating pressures are 10 to 250 psig.

Wilkerson Corp.
Englewood, Colorado

Fill in No. 133 on Reader Service Card



AIR and OIL CYLINDERS
in Industrial Applications
by Elmer F. Heiser

The first book of its kind—written by a practical man for practical men. Based on 18 years of first hand experience in working with plant people on cylinder design, selection and application.

Twenty-one chapters packed with useful information for the man who buys, uses and maintains both hydraulic and pneumatic cylinders.

One chapter—"Cushion Limitations and Variations"—is the most complete practical treatment on cushions ever published. Other chapters are devoted to Ordering Information, Standard and Not-So-Standard Cylinders, Operating Speed, Shock, Mounting Clearances, Air Power-Oil Control.

$5.00 per copy, postpaid

SERVICE DEPARTMENT
APPLIED HYDRAULICS
1240 Ontario St. • Cleveland 13, Ohio

Post Scripts of Industry

News about people, manufacturers and sales organizations

Charles T. Zaoral
The New York Air Brake Co.

Charles T. Zaoral, vice president in charge of sales and a director of the company for the past two years, was elected president of **The New York Air Brake Company. Bernard Peyton,** formerly president was elected chairman of the board.

Arthur B. Warner
Minnesota Rubber & Gasket Company

Promotion of **Arthur B. Warner** from assistant plant manager to factory superintendent at the main plant of **Minnesota Rubber and Gasket Company** was announced by Paul T. Dennison, president.

George Bell will head up West Coast operations for **Resistoflex Corporation.** He will be manager of the new bulk storage and assembly plant now being completed at Burbank, California. Bell was previously general manager of Aero-Coupling Corp., a subsidiary of Aeroquip Corp. Also announced was the appointment of **Carl A. Carlsen** as aircraft sales manager.

Herbert L. Newell
The Denison Engineering Company

Pantex Manufacturing Corporation has acquired the complete line of plug valve actuators formerly manufactured by **Valve Controls Inc.** Pantex plans to continue distribution through regular distributor channels.

Herbert L. Newell was named assistant general manager of **The Denison Engineering Company.** Newell was previously general manager of Barrett-Cravens Company.

Walter E. Max was appointed general superintendent of the **Worthington Corporation** Buffalo Works. He joined the company in 1934 as a machine shop apprentice, was named manager of the service and erection department in 1950. **Harry P. Yount** succeeds Max in his former position.

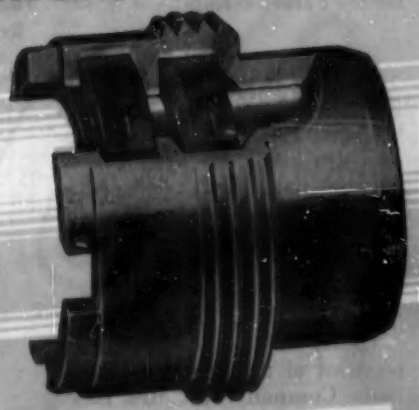
The John S. Barnes Corporation announced the following changes in sales personnel. **Tom W. Burns,** for several years a sales engineer on the home office staff, is now with the company's eastern office, Trenton, New Jersey, representing the organization in the New England division. **Bert McCleneghan,** manager of the Chicago sales office, will have general supervision of the recently opened factory branch office in Milwaukee, Wisconsin. **Keith Struthers** will be associated with McCleneghan.

Chamberlain Industries Ltd., London, England, have appointed **Drummond Asquith (Sales) Ltd.,** Birmingham as sole distributors in the United Kingdom of tube bending machinery which they design and manufacture in conjunction with Walter P. Hill Inc., Detroit, Michigan.

The Parker Appliance Company's Tube and Hose Fitting Division and the Industrial Hydraulics Division announced the promotions of **Frank Barilla** to district manager of Wisconsin and Minnesota, **W. O. Murray** to manager of western Pennsylvania and West Virginia, **Herbert H. Walley Jr.** to

HANNIFIN HYDRAULIC CYLINDERS HAVE REVOLUTIONARY NEW GLAND!

...externally removable and replaceable without dismantling cylinder!

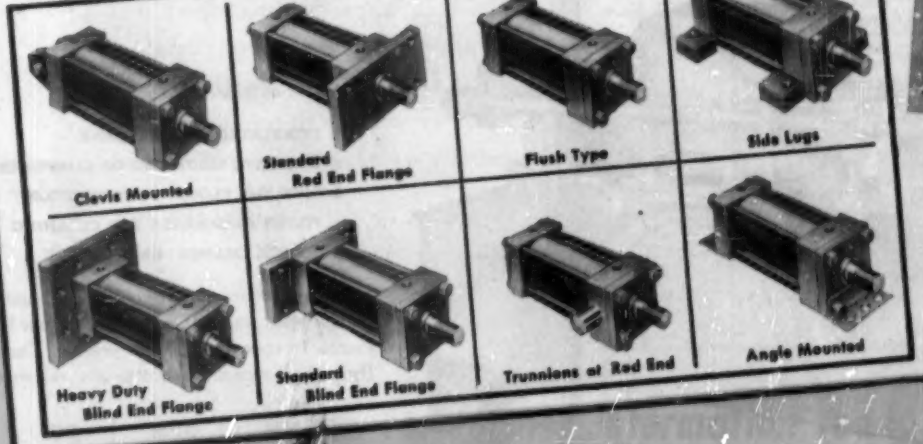


Here's the biggest improvement in cylinder design in the last 50 years. This exclusive Hannifin gland is a bronze cartridge, externally removable and replaceable as a unit to meet J.I.C. recommendations. A face type spanner wrench is the only tool you need. Now look at the packing! The "Wiperseal" serves a dual purpose as it wipes both ways to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. The "Lipseal" is self-compensating, self-relieving and non-adjustable... provides an efficient seal throughout its long life. Ask for a demonstration... every Hannifin man carries a cutaway sample of this "jewel" of a gland with him at all times.

SERIES "H" HYDRAULIC CYLINDERS

Made in 9 bore sizes from 1½" to 8"... 13 standard mountings... many combination mountings. Extremely close tolerances for easy mounting. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished then hard chrome plated for minimum friction and long packing life.

TYPICAL MOUNTING STYLES



WRITE FOR BULLETIN 113

Get your copy of this complete, easy-to-use catalog today. Everything you need to order from is here.

HANNIFIN

Hannifin Corporation, 545 South Wolf Road, Des Plaines, Illinois

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

Continued

district manager of all New England excepting Connecticut, and **Keith R. Detrich** to district manager of Kansas, Oklahoma, Missouri, Iowa and Nebraska. **Minor Rubber Co., Inc.,** Bloomfield, New Jersey, has been appointed authorized distributor for Parker O-rings.

A change in name from Sprague Engineering & Sales Corp. to **Sprague Engineering Corporation** was announced by Robert B. Sprague, president. The change in name does not in any way affect the entity or management of the corporation.

C. H. Wilkinson was elected president of the **Logansport Machine Company, Inc. Mrs. E. P. Wilkinson** resigned as president and was elected chairman of the board.

Robert B. Porter Company, Los Angeles, was appointed California factory representative and sales jobber for **Minnesota Rubber and Gasket Company's** products. Robert B. Porter, president of the California company, will be in charge of sales and service.

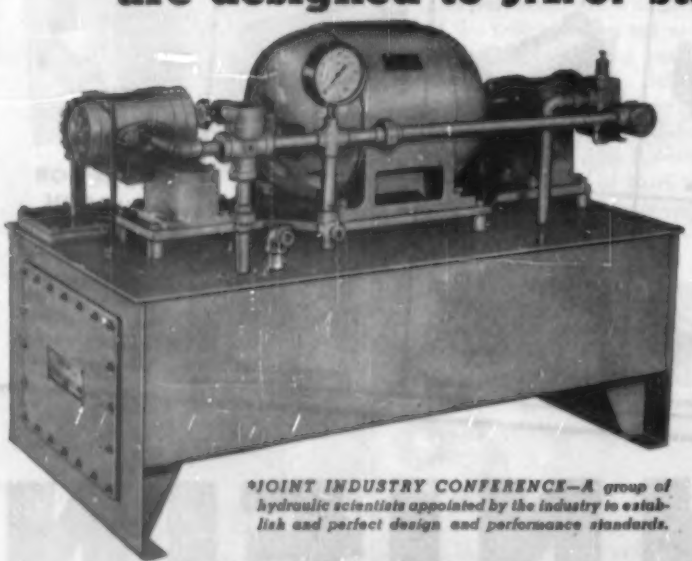
Robert B. Porter
Robert P. Porter Company

Tom Du Fresne was named manager of **The Ray M. Gordon Company's** new sales office and warehouse in Milwaukee. The company, covering Wisconsin, specializes in hydraulic, air and related automation equipment.

William Bennett was named supervisor in the up-state area of the Hydraulic Division of the **J. N. Fauver Company, Inc.** His activity will be as a specialist in this field in conjunction with the Flint and Grand Rapids offices.

Nathaniel B. Nichols, manager of **Raytheon Manufacturing Company's** research division was appointed an assistant vice president. An internationally-renowned authority in the fields of servo-mechanisms and electronics auto-

CARDWELL HYDRAULIC PUMPS
are designed to J.I.C.* standards



Here is what it means to you:

1. COMPLETELY SEALED TANK
2. SUBPLATE MOUNTING OF COMPONENTS
3. "OFF THE FLOOR" CONSTRUCTION
4. FILTER ACCESSIBLE FOR CLEANING
5. "QUICK CHANGE" DRAIN VALVE

You will get all these advantages with traditional quality when you buy Cardwell Hydraulic Power Pumps to operate all your presses. Cardwell Hydraulic Pumps are available in a wide range of

HP (Horsepower)	GPM (Gallons Per Minute)	PSI (Pressure Ranges)

*JOINT INDUSTRY CONFERENCE—A group of hydraulic scientists appointed by the industry to establish and perfect design and performance standards.

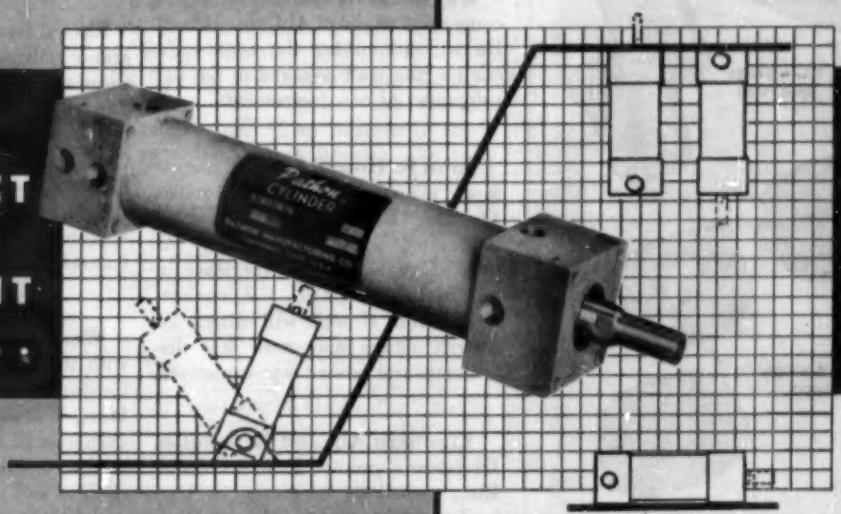
The CARDWELL MACHINE COMPANY

FRANKLIN AT 19th STREET, RICHMOND 11, VA. Quality A CARDWELL TRADITION SINCE 1909

Complete Flexibility with a Pathon

series "U" UNIVERSAL MOUNTING AIR CYLINDER

. . . they're COMPACT RUGGED EFFICIENT too . . .



Here is a new series of extremely compact air cylinders which require very small mounting area. You get four mounting types—foot, front flange, rear flange, and clevis provided integrally by drilled holes in the heads. The installation is much more rigid and assembling or stocking of miscellaneous attaching brackets is eliminated.

Stainless steel piston rods and hard drawn brass barrels assure corrosion resistants with low frictional characteristics.

STOCK SIZES: Cylinders available for immediate delivery in these sizes. **Part Numbers and Prices Shown.**

Stroke	1⅛"	1½" Bore	2"	2½"	3"
1"	UA1⅛MA1 26.00		UA2MA1 34.95		UA3MA1 46.00
2"		UA1½MA2 28.20	UA2MA2 35.60	UA2½MA2A 51.00	
4"	UA1⅛MA4A 35.20		UA2MA4A 45.20		UA3MA4A 58.40
6"		UA1½MA6A 38.20	UA2MA6A 46.50	UA2½MA6A 55.00	
8"	UA1⅛MA8A 36.80		UA2MA8A 47.80		UA3MA8A 62.00
10"		UA1½MA10A 40.20		UA2½MA10A 58.20	
12"			UA2MA12A 50.40		UA3MA12A 65.60
15"				UA2½MA15A 62.20	

Write for further information today!

Pathon MANUFACTURING CO.

3823 PACIFIC AVENUE
CINCINNATI 12, OHIO

S.S.White
PLASTIC CLOSURES
—the inexpensive way to protect valuable parts during shipment

Use them to—

- Protect threads
- Keep out dirt and moisture
- Seal in lubrication or hydraulic fluids

S.S.White plastic plugs and caps can save you thousands of dollars in damage complaints and rejections — at the cost of only a few pennies! Use them to cover openings and fittings before shipment. They're quickly and easily applied — and won't shake loose during transit. They're available in both threaded and unthreaded types and in a range of sizes and styles to meet every need.

LET US QUOTE YOU ON YOUR REQUIREMENTS

We can quickly fill your order from stock and are prepared to make up special sizes when required.

GET FULL DETAILS

Bulletins P-5203 and P-5312 have full information. Write for free copies.

THE S.S.White PLASTICS DIVISION
DENTAL MFG. CO.

Dept. L, 10 EAST 40th St., NEW YORK 16, N. Y.
Western District Office: Times Bldg., Long Beach, Cal.

Post Scripts of Industry

Continued

mation, Nichols joined the company in 1951. **Dr. K. C. Black** was named head of the communications engineering department. He was previously business manager of the Polytechnic Research and Development Company.

Raymond H. Matthews has become chief engineer of **Fenwal Inc.** He will administer the company's engineering staff engaged in the development of new instruments.

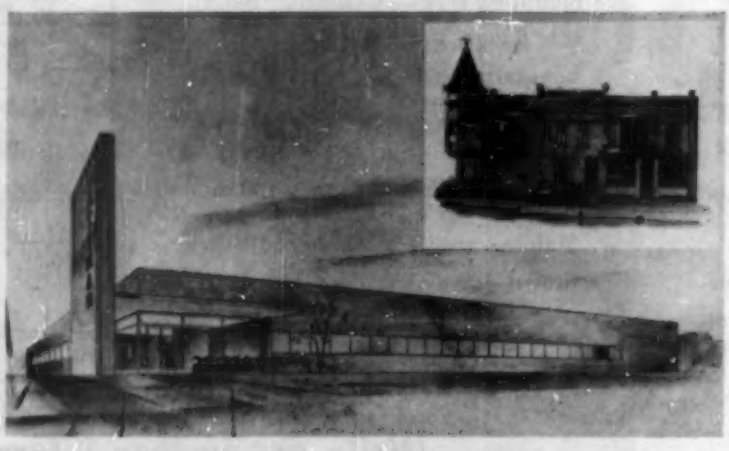
John R. Howell has been named sales manager and director of **Sterling Electric Motors, Inc.** Associated with the company for over 25 years, he has experience in all phases of the sales and management field. Howell will direct 24 district offices and over 400 distributors and service representatives.

Lindberg Air and Hydraulics Division appointed **Power Drives, Inc.,** owned by Lawrence C. Darbrake and Vincent G. Mansell, Buffalo, New York, as exclusive representative for Western New York State.

D. M. Blackmore, for the past three years New York representative for **Pacific Division Bendix Aviation Corporation,** was transferred to the West Coast. He will handle the company's hydraulic and electro-mechanical products from the North Hollywood home office.

Electro Dynamic Motor and Generator Division of **General Dynamics Corporation** has named **James A. Setchell Company** to handle sale and service of their motors and generators in Arizona, **Climax Service Company,** in Colorado. **Allan B. Collins** was appointed district manager for the Kansas City, Missouri area.

Weston Hydraulics Limited, with its plant in North Hollywood, California, was acquired by the **Borg-Warner Corp.** through an exchange of stock and will be operated as a subsidiary. The company designs and manufactures hydraulic and pneumatic equipment for the aircraft industry. Ira E. Weston will continue as president of the enterprise he founded.



Eastman Mfg. Co., Manitowoc, Wisconsin, will celebrate its 40th anniversary with the erection of a 50,000 square feet modern manufacturing plant. The company, founded in 1914, built its first plant in 1920 (picture insert), enlarged it to 30,000 square feet through the use of several floors. The new plant will not only represent an increase of 20,000 square feet, but will provide this expansion on one level. It will also allow greater facilities for the company's research and development departments, having the latest in modern test equipment.

Robert W. Bowman
Aeroquip Corp.

Kent R. Manning
Aeroquip Corp.

Aeroquip Corporation has assigned **Kent R. Manning** to the post of factory manager, appointed **Robert W. Bowman** chief industrial engineer. Manning will direct plant operations, the methods and standards, production control and purchasing departments. Bowman will serve as industrial engineering consultant for Aeroquip and Aeroquip subsidiaries.

The sixth **Plant Maintenance & Engineering Show** will be held at the International Amphitheatre, Chicago, January 24-27, 1955. It will be the first industrial exposition to occupy the huge new hall which has been built as an addition to the International Amphitheatre. Use of this hall will permit all general sessions to be held in the arena, directly adjoining the exhibits. Registration cards may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

Correction

The A. K. Allen Co., Brooklyn, N. Y. makes and stocks air cylinders in strokes up to 20 inches. The 2 inch maximum stroke noted in their ad on page 138 in the November issue was incorrect.

THE MARKET PLACE

WANTED—BUSINESS ASSOCIATE

Rapidly growing fluid power sales organization in Denver wants top hydraulic pneumatic sales engineer. Part of company available to right man. Box 12154 APPLIED HYDRAULICS

WANTED SURPLUS AIRCRAFT MATERIAL

AN Hardware and Fittings; Stainless—Aluminum—Steel—Brass (Rod & Bar) Any size, type and quantity. Get our cash offer by return mail. Send lists to: COLLINS ENGINEERING COMPANY 9050 Washington Blvd., Culver City, Calif.

WANTED—DESIGN ENGINEER

A Midwestern progressive manufacturer requires the services of one or more engineers with design and analytical experience in the field of movement and pumping of fluids (air, water, oil) on mobile equipment. Offers exceptional opportunity to competent men with complete group insurance, profit sharing and pension plan. B. S. degree in engineering or equivalent preferred. Reply will be treated confidentially. Box 12254 APPLIED HYDRAULICS.

Now Ready!

A BEGINNER'S COURSE IN BASIC PNEUMATICS

$1.00

A complete reprint of the popular "Beginner's Course in Basic Pneumatics" in permanent form.

The material has been enlarged and rearranged; two indices, one of Tables and Charts, have been added. Basic data on principles as well as components is easy to run down.

The first source for individual reference and study as well as a practical text for company pneumatic training programs.

"A Beginner's Course in Basic Pneumatics" is designed for the man who needs quick, positive orientation in fundamentals. It is the first volume to give systematic attention to the principles and basic equipment of industrial pneumatics.

$1.00 per copy, postpaid
20-99 copies 90 cents each
100 or more copies 80 cents each

SERVICE DEPARTMENT
APPLIED HYDRAULICS Magazine
1240 Ontario St., Cleveland 13, Ohio

Please send ..... Copies of "A Beginner's Course in Basic Pneumatics"

Remittance enclosed ☐; Bill our company ☐

Company .....

Name .....

Address .....

Hydraulic and Electric Circuitry

Concluded from page 47

permitted the operator to chuck and unchuck the loading spindle.

SEQUENCE CONTROL

The sequence valve just after the pump allowed oil, after a desired pressure was reached, to flow to another pilot-operated, 4-way valve and also to a 4-way pilot valve. With "port B" blocked in this cam-operated, 4-way pilot valve, the pressure could only pass through "port A" and only during index was the flow through "port A" interrupted. From "port A" the oil was directed to another 4-way pilot valve. This valve was manually operated and permitted the operator to start and stop the spindle. Manual operation of this valve controlled the piloting of one side of the sequence valve in this circuit through "port B", while "port A's" oil flow passed on to another 4-way pilot valve that was the interlock between the chucking and spindle stopping circuit. This interlock permitted oil to flow through the spindle starting and stopping circuit first, then on to the chucking circuit. This prevented the chucking or unchucking of a spindle before the spindles were stopped.

FASTER RESPONSE NEEDED

This circuit was adequate, but with the advent of carbide tools, machining time was decreasing; consequently, the need for a circuit that would respond much faster was of prime importance. To this end, we changed to a vane type, constant delivery, double pump, eliminated the sequence and 4-way pilot valve, and started using the solenoid-operated, plunger type pilot valves. We also redesigned our feed "knock-out" mechanism to be hydraulically operated and completely revamped the layout of the hydraulic circuit. The old circuit was very satisfactory, but not one that a maintenance man would enjoy working with. The circuit was very similar to our present design, but was difficult to assemble and service. To overcome these undesirable features, we designed a very unique hydraulic panel, redesigned our spindle clutch and brake mechanism, our main hydraulic distributor and added power reverse. We have also taken advantage of an accumulator as an internal leakage compensator in our chucking circuit and another one in our feed and reverse circuit for more instantaneous response.

MAINTENANCE SIMPLIFIED

These changes have proved very beneficial to maintenance men in the field, because our present circuit is made up of easy-to-handle, packaged hydraulic sub-assemblies. While we feel we have come a long way in achieving a simplified hydraulic circuit, we can also appreciate the great strides that the hydraulic equipment manufacturers have made. As they improve and introduce new products, we also benefit.

JUST OFF THE ASSEMBLY LINE . . .

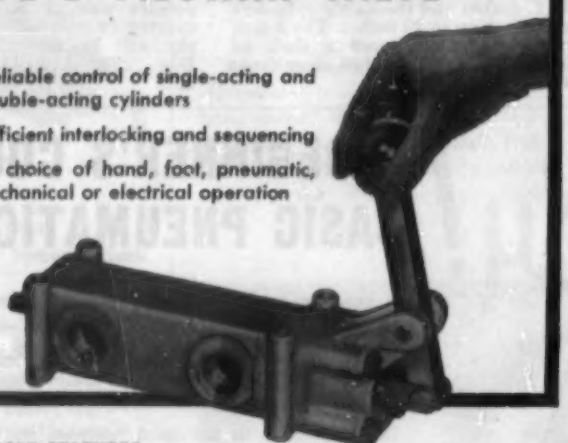
New Flow Valve

WESTINGHOUSE
TYPE D PILOTAIR VALVE

Gives you reliable control of single-acting and double-acting cylinders

Gives you efficient interlocking and sequencing

Gives you a choice of hand, foot, pneumatic, mechanical or electrical operation



YOU'LL LIKE THESE FEATURES

3,125 USES. Every valve is made up from a number of sections that bolt together to give any type of operation.

PRESSURE SEAL STAYS IN THE GROOVE. Completely new Westinghouse seal can't roll out of position . . . will not nick, scar, or chip.

LONG LIFE, LOW MAINTENANCE. No moving metal parts rub against metal. Valve spool floats on rubber. Stainless steel spool and aluminum alloy body resist corrosion.

WRITE FOR MORE FACTS or get in touch with your local Westinghouse Air Brake Co. Distributor. He is listed in the classified phone book under "Cylinders: Air."

Westinghouse Air Brake
COMPANY
Industrial Products Division
WILMERDING PENNSYLVANIA

Pneumatic cylinders, valves, engineered pneumatic systems and air control devices of all kinds.
Factory Branch: Emeryville, Calif. Distributors throughout the United States.
Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario.

Two Pump Metering Circuit

Concluded from page 36

than that obtained from the previous control, in this respect.

Since the resistance of the arc, the source of heat within the furnace, is already a function of both the arc current and arc voltage, balancing the arc current against the arc voltage is questionable and may account for the erratic results experienced under certain operating conditions. The control has no fixed standard against which to regulate.

Further development led to the latest type of arc-furnace control shown in Figure 1. This is, essentially, an air-counterbalanced, hydraulic differential, energized directly from the furnace bus. It is fundamentally a different type of arc furnace control. It eliminates the special differential field rotary generator. Its electrode motor is driven directly from the furnace bus instead. The motor uses energy that is inversely proportional to the energy of the arc—not just the product of any voltage and current. It takes the right combination of these two to get the required energy (heat) into the furnace. This air-counterbalanced, hydraulic differential controls that combination.

With the elimination of the special generator went the circuit complications, maintenance and time lag it introduced, and the special secondary current transformers with their tempermental characteristics, too.

The electrode motor regulates at or near rated rpm where it has the power and energy to do the job correctly, easily and quickly. (One can accelerate or decelerate a car from 50 mph to 60 mph easily and quickly but from 5 mph forward to 5 mph rearward is something else. The question is twofold: Does it require the same power and energy? Is the power and energy available at the reduced motor rpm?) Electrode motors regulating at or near rated rpm do their job without overheating and straining. At these speeds they cool themselves and do not require high, suddenly applied torques to develop the required horsepower and do the required work.

Since even minute changes in current or torque result in proportional changes in speed of the motor and electrode, this new control actually regulates the electrode speed in true proportion to arc off-balance over a much wider range.

The electrode motor (M_2 in Figure 1) that does all the work of supplying the required pressure to lift the electrode is a constant speed motor, eliminating the problem of inertia just as reactance is eliminated in a d-c circuit. In fact, serious consideration is being given to putting a flywheel on this motor to obtain from it added energy required for instant acceleration of the largest electrodes. This constant speed motor is the fixed, standard reference against which the furnace is regulated and nothing happening within the furnace or power supply can upset it to make the control hunt or surge.

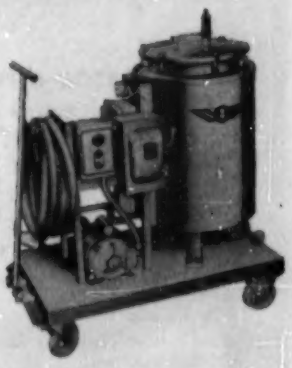
The steps of development clearly indicate that improvement in operation was the result of simplifying the electrical circuit and replacement of a mechanical hoist with an oil powered cylinder.

clean oils... are safe oils

protect your hydraulic equipment

with this

PORTABLE



HOFFMAN FILTER

This HOFFMAN PORTABLE CARTRIDGE FILTER helps keep your hydraulic machinery and equipment running at peak efficiency . . . anywhere in your plant.

The free-moving HOFFMAN CARTRIDGE FILTER prevents hydraulic machinery shut-downs due to dirty oils . . . banishes sticky valves . . . prevents component failure. It hooks into the oil system without interrupting machine operation for a fast thorough filtering job to eliminate acids, gums, resins, sludge, dirt and other insolubles.

Initial cost and upkeep are so low that savings in oil and reduced machine downtime let you write off initial investment in a hurry.

Built in 30 and 60 GPH capacities with repackable or throw-away cartridges—especially useful where continuous filtration is not needed.

HOFFMAN DISC FILTER, especially suited for continuous filtration where space is limited and initial cost is a prime factor. Designed to operate at pressures up to 50 lbs. Flow rates from 1 to 125 GPM; removes particles as small as 5 microns.

The HOFFMAN OIL CONDITIONER—combining a filter and a vaporizer—provides continuous, complete conditioning of contaminated hydraulic oils. All solids and solubles removed. Capacities range from 25 to 600 GPH.

Consult HOFFMAN Filtration Engineers about your maintenance problems in oil and other fluids.

Mail this coupon for specific information on the various types of HOFFMAN INDUSTRIAL FILTRATION EQUIPMENT.

INDUSTRIAL FILTRATION DIVISION

U.S. HOFFMAN MACHINERY CORP.

DEPT. AH, 105 FOURTH AVE., NEW YORK 3, N. Y.

U. S. HOFFMAN Machinery Corp.
Dept. AH, 105 Fourth Ave., New York 3, N. Y.

Please send me the bulletins checked on Hoffman Filtration Equipment.

Name.....

Address.....

City.....State.....

___ Disc Filters
___ Cartridge Filters
___ Oil Conditioners
___ Pressure Filters
___ Coolant Clarifiers
___ Magnetic Separators
___ Vacuum Filters
___ Vacuum Stills

1954 APPLIED HYDRAULICS Editorial Index

ACCUMULATOR CIRCUITS

Accumulator Circuit Reduces Operating Temperature and Gives Constant Cycle Time
By C. B. Blake and A. M. Steel — June p 60

Accumulator Cut-Out Circuit Reduces Fire Hazard
By Jack E. Bullen — Oct. p 116

A New Approach to the Design of Central Hydraulic Systems
By William W. Lytle — May p 72

How to Prevent Hydraulic Shock on Mobile Equipment
By Lee Drasin and Walter Stampfl — Oct. p 72

3 Pressure Switch Controlled Accumulator Circuits
By Rupert P. Esser — June p 68

ASSOCIATION and TECHNICAL MEETINGS

National Conference on Industrial Hydraulics 1954 — Oct. p 63

National Fluid Power Association Meeting — June p 110

NCIH Holds Outstanding 10 Anniversary Meeting — Dec. p 76

1954 Fall Meeting of The National Fluid Power Association — Nov. p 76

Report of the Machine Tool Hydraulics Forum — July p 78

SAE Aircraft Meetings — June p 92

Summaries of NCIH Technical Papers — Oct. p 66

10th Annual Hydraulics Conference — Aug. p 48

10th National Conference on Industrial Hydraulics — Sept. p 59

AUTOMATIC MACHINERY

Control Circuits for Fluid Powered Work Transfers — July p 55

Mechanical Design for Transfer Devices
By Frank Zagar — July p 58

Oil Powered Robot Does the Work of Many Hands
By Bruce Barton and Jack K. Grimm — Oct. p 92

What's So New About Automation? — July p 53

AVIATION APPLICATIONS

Brake Design for Jet Aircraft Gives Split-Second Response
By Joseph N. Steinmetz, Jr. — June p 86

Design of a Hydraulically Operated Aircraft Windshield Wiper
By C. R. Sacchini — Feb. p 53

Hydraulic Transmission for Aircraft Accessory Drives
By C. L. Sadler — Feb. p 56

Low Pressure Bleeding of Aircraft Brake Systems
By Robert Spurr — Dec. p 52

Moisture And Pressure Control in a High Pressure Pneumatic Circuit
By J. L. Dooley and H. D. Samuel — May p 100

Oil Powered Simulator Calibrates Jet Engine Fuel Controls
By W. S. Bobier, Jr. — Sept. p 86

Potential Advantages of the 5000 Psi Pneumatic System
By A. E. Schmidlin — Oct. p 118

"Power in a Smaller Package"—Evaluating 5000 Psi Hydraulic Systems
By Joseph N. Steinmetz, Jr. — Nov. p 80

Swivel Fittings for Aircraft Hydraulic Systems
By Michael Tarasewich — July p 86

Symposium on Aircraft High Temperature Static Seals — Nov. p 92

Testing Aircraft Compressors — Mar. p 100

Trends in British Aircraft Pumps
By John A. Lankester — Aug. p 56

BASIC PNEUMATICS

Basic Pneumatics Section
Section III, Power And Working Elements

Air Valves Part 6 — Mar. p 78
Part 7 — Apr. p 106
Part 8 — June p 114

COMPONENT DESIGN

Back Pressure . . . How it Affects Valve Operation
By John J. Pippenger — Oct. p 85

Design of a Reciprocating Oil Intensifier
By Frederick J. Shaltz — Nov. p 55

Fan Belt Driven Hydraulic Pump
By George D. Nichols — Sept. p 94

Hydraulic Noise in Positive Displacement Pumps Part 1 Gear Pumps
By E. L. Midgette — Aug. p 41

Hydraulic Noise in Positive Displacement Pumps Part 2 Vane and Piston Pumps
By E. L. Midgette — Sept. p 66

Will 2300 GPM-3000 PSI Pumps Open New Fields? — Feb. p 45

ELECTRICAL CONTROL DESIGN

Control Circuits for Fluid Powered Work Transfers — July p 55

Electro-Pneumatic System on Induction Hardening Equipment
By Atlee M. Knorr — Oct. p 80

Hydraulic and Electric Circuitry for Machine Tools
By H. W. Brown and J. H. Smith — Dec. p 44

Shock Tests Made Safer With Electrically Controlled Circuit
By Walter Hermann, Vaughn L. Beals, Jr. and Emmett A. Witmer — Nov. p 72

3 Pressure Switch Controlled Accumulator Circuits
By Rupert P. Esser — June p 68

Valve Actuation with Rotary Solenoids Permits Compact Package Design
By Bernard B. Becker — June p 74

FEED CIRCUITS

Comparing Cam and Solenoid Operated Feed Circuits
By E. H. Garwood — Sept. p 70

How to Put a Hydraulic Feed on a Portable Electric Drill
By Halvor E. Anderson — Oct. p 99

Hydraulic Drill Feed Design
By Paul Romine and Andrew Armstrong — June p 65

You Can Get Gentle, Smooth Motions with Low Pressure Cylinders
By Joe Clancy — Mar. p 59

Controlled Feeds and Speeds Give Constant Chip Load
By Edward Smith — Oct. p 127

FILTER APPLICATION

Where Should a Filter Be Located in a Hydraulic System — Aug. p 52

HYDRAULIC FLUIDS

High and Low Range Aniline Point — Apr. p 86

How to Prepare Circuits for Water-Base Nonflammable Fluids — Feb. p 109

Industrial Nonflammable Fluids — Mar. p 65

HYDRAULIC TRANSMISSIONS

Controlled Speed, Thrust and Torque
By Fred D. Wright and Lewis H. Brakel — Aug. p 44

Fluid Motor Drive for Rotary Cutting Tools
By Frank Zagar — Apr. p 79

How Mall Tool Puts Safety in Hydraulic Lines

FIRE-RESISTANT PYDRAUL F-9

How to make die-casting machines safer for operators, more efficient in production? Mall Tool, manufacturer of more than 1000 separate portable items—many of them die-cast—does it this way:

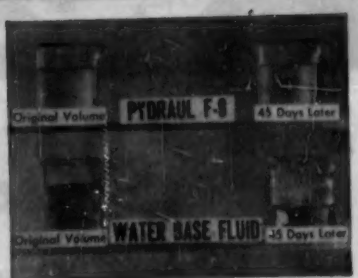
One by one, they are converting their machines to Pydraul F-9. Under test, this remarkable hydraulic fluid will not sustain flame even when sprayed into a 6000° F. oxyacetylene jet. If a hose should rupture, Pydraul would spray harmlessly into pots of liquid metal or even into furnace flames.

No waste, no corrosion. Mall finds oil make-up per machine averages 60% less with Pydraul than with ordinary fluid. Pydraul has a chemical base—not water or petroleum—and is noncorrosive to metal parts. It can be re-used again and again with no loss of lubricating characteristics.

Soon all Mall hydraulic machines will have Pydraul in their lines.

Pydraul's recent price reduction makes it more than ever the most economical fire-resistant fluid in actual use.

Write for this engineering report, "Pydraul F-9." Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478, St. Louis, Missouri.



37% less evaporation in Pydraul than in water-based fluids . . . one reason why make-up rates are many times lower with the Monsanto fluid.

Pydraul: Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND

1964 EDITORIAL INDEX

How to Select a Fixed Displacement Pump and Motor Drive
By Gene Roberts Nov. p 68

Hydraulic Drives for Continuous Process Industries
By Ransom Tyler July p 64

Variable Speed for Wire Covering Machine
By C. G. Ellis May p 64

Variable Speed Hydraulic Transmissions May p 63

INSTALLATION IDEAS

Mounting a Trunnion Cylinder in Limited Space
By C. B. Blake and A. M. Steel Apr. p 82

Sectionalized Panels Permit Assembly Line Techniques Mar. p 73

Shop-Built Box Former Saves $1200 a Year Dec. p 40

MACHINE CIRCUITS

Air Cylinder Powers Non-Paralleled Broaches Feb. p 40

Air and Oil Circuits Are Combined for Resistance Welding
By Leroy R. Conklin Feb. p 33

Air Pilot Circuit Actuates Sliding Stem Valve Aug. p 50

Built-In Air-Hydraulic Jacks Pay for Themselves Every Time They're Used
By George D. Becker Sept. p 57

Circuits Simplify Wire Forming Feb. p 48

Design of Hydraulic Straightening Press Assures Accessibility for Maintenance Dec. p 38

Differential Circuits
By James Tankard Sept. p 63

Don't Foul the Line
By Peter L. De Marth Mar. p 76

Fluid Motor Drive for Rotary Cutting Tools
By Frank Zagar Apr. p 79

Fluid Power Circuits
By Paul Rolnick Jan. p 33

How to Change a Geared Planer to Oil Power
By William J. Endicott Oct. p 89

Hydraulic Control System for 6-Speed Chucking Machine
By R. C. Ebersold July p 69

Lower Machine Costs With Circuit Redesign
By Harry Mortenson July p 72

Oil Controlled Spindle Positioning Attachment
By Karl Schubert Oct. p 76

Oil Powered Devices Add Speed and Accuracy to Thread Millers Sept. p 69

Oil Powered Rotary Actuator Solves a Positioning Problem June p 82

Problem Clinic—Proper Valve Selection Eliminates Motions Apr. p 140

Proper Hydraulic Circuit Design Can Reduce Fire Hazards May p 78

Replenishing Circuit Keeps Series Connected Cylinders in Step Oct. p 96

Safe Cut-Off Control Is Provided by Seven Air Valves
By Wesley Grotewohl Oct. p 100

Sequence Control on Multiple Spot Welders
By John Sant June p 63

Two Pump System Provides Synchronized Motion
By L. Arthur Lassman Sept. p 60

MAINTENANCE METHODS

Air Powered Lube System Protects Conveyor Lines
By Carl S. Abbott Dec. p 48

How to Care for Hydraulic Oils
By John R. McCoy Nov. p 64

Industrial Hydraulic Training Programs Oct. p 144

Maintenance Hints Will Increase Component Life Aug. p 40

MATERIAL HANDLING APPLICATIONS

Air Circuit Controls Transfer Device
By George R. McKee Apr. p 66

After two years of research

A **RELIEF VALVE** THAT **DOESN'T LEAK!**

- In-line design
- Adjustability that can't be tampered with
- Excellent flow characteristics
- Precise operating reliability
- Suitable for almost any gas or liquid

Send for information today..... ☐

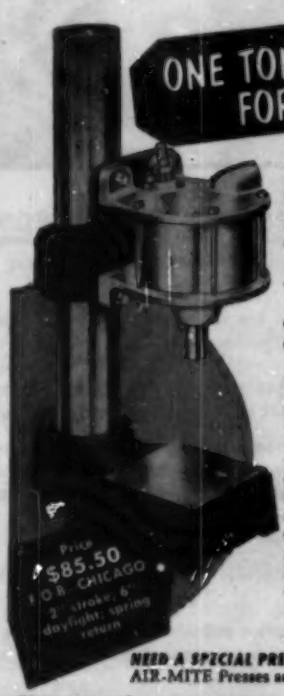
CIRCLE SEAL *precision valves*

Representatives in Principal Cities.

JAMES•POND•CLARK

2181 East Foothill Blvd • Pasadena 8, California

Fill in No. 49 on Reader Service Card



YES—AND YOU CAN'T BEAT IT FOR QUALITY!

Air-Mite Air Arbor Press Features:

- **Solid Steel Column—greater strength, rigidity**
- **Bronze Cylinder, Aluminum End Castings, Neoprene Piston Cups**
- **Accurately ground 8" x 8" table**
- **Quick set-up and stroke adjustment for maximum flexibility**

You get more for your money when you choose AIR-MITE—more press, more utility and more production. Built by air press specialists to meet the demand for a low cost unit that could stand the gaff of high production work, AIR-MITE presses will show you quality, efficiency and economy you never thought possible at their price. Made in ¼, ½, ¾ and 1 ton capacities with spring or air return.

Write for complete catalog on AIR-MITE Presses and Air Cylinders.

NEED A SPECIAL PRESS? Many special adaptations of AIR-MITE Presses are available. Write us your needs.

AIR-MITE Devices, Inc.

4615 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

Fill in No. 3 on Reader Service Card

Fill in No. 94 on Reader Service Card

Need Special Service on a Tubing Problem?

•

Call or Write

Summerill Tubing Division
Columbia Steel & Shafting Co.
PITTSBURGH 30, PA.

•

Manufacturers of
Cold Drawn Seamless Steel Tubing

HYDRAULIC TUBING • PRESSURE TUBING
CONDENSER TUBING • MECHANICAL TUBING
DIESEL ENGINE TUBING • AIRCRAFT TUBING
SPECIAL SHAPES

Extend O-Ring Service Life

Shamban KELON-T (Teflon*) spiral, chamfered back-up rings improve performance by preventing extrusion and reducing friction. Spiral back-ups, heat-resistant, non-corrosive and chemically-inert, are specified for adverse environmental conditions. Shamban's back-ups are produced to the latest Military Standards MS 28782 and MS 28783. For added convenience and protection, they are packaged on mandrels in tubular containers.

*Du Pont Trade-mark

KELON **W. S. SHAMBAN & CO.**
11617 West Jefferson Blvd., Culver City, Calif.

What a sight! CENTURY'S All-new Oil Level Sight Gage

No Easier Installation Ever Designed

Better Visibility at any Height

Streamlined Modern Appearance

Leak-proof —No Dripping

Important Savings in COST

Available NOW From STOCK!

Inquire today . . . make immediate use of the sensational advantages in cost and services offered by this new gage . . .

Century HYDRAULICS DETROIT, MICH.
CENTURY HYDRAULICS, INC.
8866 GREENFIELD — DETROIT 28, MICHIGAN

 Fill in No. 83 on Reader Service Card

Fill in No. 23 on Reader Service Card

1954 EDITORIAL INDEX

Air Operated Turnover Pays Off in 11 Weeks July p 62

Air Powered Jig Tilts and Turns for Packaging Operation June p 76

Air Powered Strapping Machine Reduces Handling Costs May p 92

MOBILE EQUIPMENT

Chain Linkages for Hydraulically Powered Machines May p 67

Controlled Speed, Thrust And Torque
By Fred D. Wright and Lewis H. Brakel Aug. p 44

Fluid Lines and Fittings for Mobile Equipment
By J. E. Jass Feb. p 41

High Pressure Hydraulic Control on Mobile Equipment May p 80

How to Prevent Hydraulic Shock on Mobile Equipment
By Lee Drasin and Walter Stampfl Oct. p 72

Valve Actuation with Rotary Solenoids Permits Compact Package Design
By Bernard B. Becker June p 74

PACKINGS

Bonded Seals . . . How and Where to Use Them
By John Lankester May p 69

Mechanical Seals for Hydraulic Equipment
By J. B. Stevens and Harold F. Griener June p 70

Packing Cartridge for a Telescoping Cylinder Sept. p 76

Spring Loaded Packings
By James M. Bradbury Oct. p 124

The "O" Ring Spiral Failure Problem Mar. p 90

PRESS INSTALLATIONS

Can Shop-Built Air Presses Assemble Your Product?
By Tom Jeffrey Apr. p 74

Floating Cushion Protects Dies from Overload
By Robert Soman Apr. p 92

Inverted Press Design Simplifies Use of Auxiliary Cylnders Aug. p 35

Press Revamp Uses Air-Oil Booster June p 80

Pump Control System for Large Press Installation
By C. B. Blake and A. M. Steel Mar. p 74

Simplified Valving
By Louis Zimmerman Feb. p 37

Single Stroke Compacting Press . . . New Ram Application
By C. C. Fishburne Oct. p 106

Two-Pressure Circuit Uses Pilot Controlled Relief Valve
By Hadley Kline and Henry Green Sept. p 74

Want Faster Operation? Use Air Circuits Mar. p 70

SERVO SYSTEMS

An Electro-Hydraulic Servo Pump
By Norton Williams Mar. p 63

Master and Slave Circuits for Remote Positioning
By Edmund L. Nichols Nov. p 57

Servo Controlled Power Cylinder Positions the Load
By Walter C. Carruth, Jr. Oct. p 112

Two Pump Metering Circuit Solves Costly Control Problem
By C. W. Vokac Dec. p 33

SPECIAL PLANT EQUIPMENT

Air Devices Assure Accuracy for Blending Materials
By Fred G. Herr May p 84

Electro-Pneumatic System on Induction Hardening Equipment
By Atlee M. Knorr Oct. p 80

Remotely Controlled Hydraulics Positions "Hot" Materials in Radiation Lab.
By Charles M. George Aug. p 33

SYSTEM PLUMBING

Fluid Lines and Fittings for Mobile Equipment
By J. E. Jass Feb. p 41

SPEEDY AIR VISE

SPEEDS UP

√ MILLING √ PUNCHING
√ DRILLING √ BENDING
√ TAPPING √ RIVETING

GRIPPING FORCE 15 TIMES AIR LINE PRESSURE

Speedy Air Vise helps you do dozens of operations faster, better, cheaper—by air pressure! Foot control valve opens and shuts vise instantly, leaving *both* hands free to produce *more!* Jaw opens up to 3 inches, holds castings, parts, jigs, etc. Compact and trouble-free.

Complete with Foot Control, Air Hose and Fittings.....only $36.00

Prompt Delivery from Your Supplier or Write Direct

W. S. BROWN CORPORATION • 3035 N. Hermosa Ave. • Chicago 35, Ill.

AIR REGULATORS • AIR FILTERS • AIR GUNS • PORTABLE COMPRESSORS

A New Gresen Product

DIFFERENTIAL RELIEF VALVE

Of Greater Capacity

Model D75

The Quality Valve At Mass Production Prices.

Features

★ Grey Cast Iron Body
★ Hardened Steel Plunger and Seat
★ Smooth Operating Pressure Regulating Screw
★ Light Spring Has Long Life and Low Stress

Pressure Range: 50 to 1250 P.S.I.
Capacity: 24 G.P.M. @ 15 ft/sec

Relief valve of smaller capacity available in our Model DR75.

Write for Literature

GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-93 Minneapolis 11, Minn.

Fill in No. 19 on Reader Service Card

Fill in No. 41 on Reader Service Card

Hydraulic Hose . . . Construction . . . Selection . . . Application
By J. A. Muller Aug. p 37

TEST EQUIPMENT

Circuit Design for Shop-Built Test Stand to Check Pressure and Flow
By J. A. Ackermann May p 76

Design of an Aircraft Pump Test Stand
By Roland N. Crossley Apr. p 102

High Pressure Testing of Air and Oil Cylinders June p 78

Hydraulic Test Circuit for Jet Aircraft Exhaust Nozzle Actuation
By Andrew J. Auld, Jr. Mar. p 96

Layout and Instrumentation for Testing Triplex Pumps
By J. E. Davee Sept. p 80

Portable Test Stand Construction for Checking Pneumatic Tools Nov. p 62

Republic Opens High Temperature Lubricant Laboratory Aug. p 66

Standardizing Test Equipment
By Julius Keadall May p 106

Testing Pneumatics and Hydraulic Components
By Harry P. Kupiec Apr. p 94

TOOLING APPLICATION

Air Actuated Brazing Setup Gives Cycle Control and Protection
By Andrew M. Damer Apr. p 64

Air Operated Devices Speed Machine Loading Dec. p 72

Air Power Clamps then Ejects Small Parts
By T. Baxter and C. Spicer Apr. p 84

Complicated Bar Bending with Hydraulic Power Dec. p 41

Fluid Power for Better Tooling Apr. p 63

Hydraulic Piercing Tools Increase Production 400% Apr. p 71

Ideas for Reducing Operating Costs of Air Powered Tooling Apr. p 76

Is Your Hydraulic Tooling Safe?
By H. L. Stewart Apr. p 68

23 Screws Are Tightened and Staked During an Automatic Cycle Apr. p 73

AUTHOR INDEX

Abbott, Carl S.
Air Powered Lube System Protects Conveyor Lines Dec. p 48

Ackerman, J. A.
Circuit Design for Shop-Built Test Stand to Check Pressure And Flow May p 76

Anderson, Halvor E.
How to Put a Hydraulic Feed on a Portable Electric Drill Oct. p 99

Armstrong, Andrew and Paul Romine
Hydraulic Drill Feed Design June p 65

Auld, Andrew J. Jr.
Hydraulic Test Circuit for Jet Aircraft Exhaust Nozzle Actuation Mar. p 96

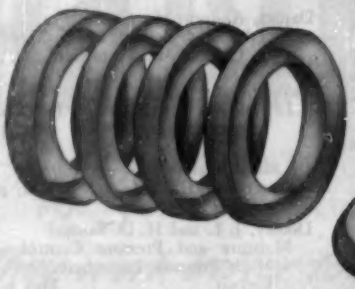
Barton, Bruce and Jack K. Grimm
Oil Powered Robot Does the Work of Many Hands Oct. p 92

Baxter, T. and C. Spicer
Air Power Clamps then Ejects Small Parts Apr. p 84

CHEMISEAL MADE OF TEFLON PACKINGS
Impervious to All Hydraulic Fluids

Chemiseal packings — made of duPont TEFLON — have zero swelling in all hydrocarbons and new synthetic hydraulic fluids and solvents. Service temperature range from minus 110° F to plus 500° F. They are unsurpassed in anti-friction properties, waterproof, non-flammable, long wearing. Because chemically impervious — chemical inspections can be eliminated. Regarded by commercial and military engineers as the finest hydraulic packing for plane or plant.

CHEMISEAL V-TYPE PACKING



Try Chemiseal V-type packings of pure TEFLON for hydraulic valves. Seal with low gland pressure and operating torque. Extremely resilient, tough, anti-hesive—they are ideal for either manual or automatically operated valves. Supplied in sets with square-end TEFLON adaptors. Ask for Catalog TP-1053.

CHEMISEAL BACK-UP RINGS

Try Chemiseal back-up rings of pure TEFLON. They greatly lengthen "O" ring life and prevent extrusion. Available in solid, split and the spiral type, preferred by engineers. All commercial and AN sizes for "O" ring packings, gaskets and universal fittings. Write for Catalog OB-1152.

OTHER CHEMISEAL HYDRAULIC PACKINGS

Other United States Gasket Company engineered packings include "U" Rings, Cup Packings and Flange Packing—all made of pure duPont TEFLON with the same ideal characteristics of corrosion resistance, long life, zero swelling, extreme anti-hesiveness, and wide service temperature range. Write for further information.

UNITED STATES GASKET COMPANY
CAMDEN 1 • NEW JERSEY

1964 EDITORIAL INDEX

Beals, Vaughn L. Jr., Walter Hermann, and Emmett A. Witmer
Shock Tests Made Safer with Electrically Controlled Circuit Nov. p 72

Becker, George B.
Built-In Air-Hydraulic Jacks Pay for Themselves Every Time They're Used Sept. p 57

Becker, Bernard B.
Valve Actuation with Rotary Solenoids Permits Compact Package Design June p 74

Blake, C. B. and A. M. Steel
Accumulator Circuit Reduces Operating Temperature and Gives Constant Cycle Time June p 60

Blake, C. B. and A. M. Steel
Pump Control System for Large Press Installation Mar. p 74

Blake, C. B. and A. M. Steel
Mounting a Trunnion Cylinder in Limited Space Apr. p 82

Bradbury, James M.
Spring Loaded Packings Oct. p 124

Brakel, Lewis H. and Fred D. Wright
Controlled Speed, Thrust and Torque Aug. p 44

Brown, H. W. and J. H. Smith
Hydraulic and Electric Circuitry for Machine Tools Dec. p 44

Bullen, Jack E.
Accumulator Cut-Out Circuit Reduces Fire Hazard Oct. p 116

Carruth, Walter C., Jr.
Servo Controlled Power Cylinder Positions the Load Oct. p 112

Clancy, Joe
You Can Get Gentle, Smooth Motions with Low Pressure Cylinders Mar. p 59

Conklin, Leroy R.
Air and Oil Circuits Are Combined for Resistance Welding Feb. p 33

Crossley, Roland N.
Design of an Aircraft Pump Test Stand Apr. p 102

Damer, Andrew M.
Air Actuated Brazing Setup Gives Cycle Control And Protection Apr. p 64

Davee, J. E.
Layout and Instrumention for Testing Triplex Pumps Sept. p 80

De Marsh, Peter L.
Don't Foul the Line Mar. p 76

Dooley, J. L. and H. D. Samuel
Moisture and Pressure Control in a High Pressure Pneumatic Circuit May p 100

Drasin, Lee and Walter Stampfl
How to Prevent Hydraulic Shock on Mobile Equipment Oct. p 72

Ebersold, R. C.
Hydraulic Control System for 6-Speed Chucking Machine July p 69

Ellis, C. G.
Variable Speed for Wire Covering Machine May p 64

Endicott, William J.
How to Change a Geared Planer to Oil Power Oct. p 89

Esser, Rupert P.
3 Pressure Switch Controlled Accumulator Circuits June p 68

Gatwood, E. H.
Comparing Cam and Solenoid Operated Feed Circuits Sept. p 70

George, Charles M.
Remotely Controlled Hydraulics Positions "Hot" Materials in Radiation Lab Aug. p 33

Green, Henry and Hadley Kline
Two-Pressure Circuit Uses Pilot Controlled Relief Valve Sept. p 74

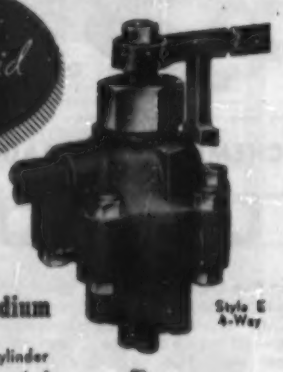
Griener, Harold F. and J. B. Stevens
Mechanical Seals for Hydraulic Equipment June p 70

Fishburne, C. C.
Single Stroke Compacting Press . . . New Ram Application Oct. p 106

Grimm, Jack K. And Bruce Barton
Oil Powered Robot Does the Work of Many Hands Oct. p 92

NICHOLSON

VALVES for Air & Fluid Power



Style E 4-Way

Solenoid, Motor, Lever, Foot types for every medium

Nicholson furnishes valves for cylinder control, distributing, metering and for many special operating cycles. Installations in a wide range of plants have been in constant service for well over 25 years. In addition to their long wear and minimum maintenance, Nicholson valves feature: specially treated hard seats; and lapping flat discs which actually become tighter with use; choice of 6 metal combinations to suit your specific service; positive protection against grit. Sizes, ⅛" to 2½". Pressures up to 5000 lbs.

Send for Catalog

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

213 Oregon St., Wilkes-Barre, Pa.

COMPRESSED AIR AND GAS COME OUT OF THE LOGAN

ARIDIFIER

Scrubbed CLEAN AND DRY

INSTALL ARIDIFIERS ON LINES SERVING

- Paint Spray Guns
- Air Tools
- Air Hoists
- Foundry Jolting Machines
- Sand Blasting Tools
- Sand Blasting Rooms
- Metal Spray Guns . . . or Wherever the line must deliver clean, dry air or gas

On any air or gas line 92% of the dirt, oil, scale and water that enter the Aridifier is trapped and removed from circulation. The Aridifier's patented centrifugal-baffle action scrubs air and gas clean and dry . . . protects equipment, prevents freezing, fouling, corrosion and caking, produces best results with spray gun and air tool operations, etc. Easy to install. Self cleaning. Maintains itself. 10 models available. Capacity 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.

Write for This Catalog Now!

Logan ENGINEERING CO.

4920 W. Lawrence Ave., Chicago 30, Ill.

Fill in No. 68 on Reader Service Card

Fill in No. 58 on Reader Service Card

RACINE
RACINE
RACINE
RACINE
RACINE
RACINE
RACINE
ALL COMPONENTS
FOR ANY HYDRAULIC CIRCUIT
"They work better together"
WRITE FOR NEW CATALOG AND
NAME OF NEAREST FIELD OFFICE.
Complete Engineering Service
Available without charge. Address:
RACINE HYDRAULICS & MACHINERY, INC.
2074 ALBERT ST., RACINE, WISCONSIN, U.S.A.
RACINE
RACINE HYDRAULICS & MACHINERY, INC. RACINE, WISCONSIN

1954 EDITORIAL INDEX

Grotewohl, Wesley
Safe Cut-Off Control Is Provided by Seven Air Valves Oct. p 100

Herr, Fred G.
Air Devices Assure Accuracy for Blending Materials May p 84

Hermann, Walter, Vaughn L. Beals, Jr., and Emmett A. Witmer
Shock Tests Made Safer with Electrically Controlled Circuit Nov. p 72

Jass, J. E.
Fluid Lines and Fittings for Mobile Equipment Feb. p 41

Jeffrey, Tom
Can Shop-Built Air Presses Assemble Your Product? Apr. p 74

Kendall, Julius
Standardizing Test Equipment May p 106

Kline, Hadley and Henry Green
Two-Pressure Circuit Uses Pilot Controlled Relief Valve Sept. p 74

Knorr, Attlee M.
Electro-Pneumatic System on Induction Hardening Equipment Oct. p 80

Kupiec, Harry P.
Testing Pneumatics and Hydraulic Components Apr. p 94

Lankester, John A.
Bonded Seals . . . How and Where to Use Them May p 69

Lankester, John A.
Trends in British Aircraft Pumps Aug. p 56

Lassman, L. Arthur
Two Pump System Provides Synchronized Motion Sept. p 60

Lytle, William W.
A New Approach to the Design of Central Hydraulic Systems May p 72

McCoy, John R.
How to Care for Hydraulic Oils Nov. p 64

McKee, George R.
Air Circuit Controls Transfer Device Apr. p 66

Midgette, E. L.
Hydraulic Noise in Positive Displacement Pumps
Part 1 Gear Pumps Aug. p 41
Part 2 Vane and Piston Pumps Sept. p 66

Mortenson, Harry
Lower Machine Costs with Circuit Redesign July p 72

Miller, J. A.
Hydraulic Hose . . . Construction . . . Selection . . . Application Aug. p 37

Nichols, Edmund L.
Master and Slave Circuits for Remote Positioning Nov. p 57

Nichols, George D.
Fan Belt Driven Hydraulic Pump Sept. p 94

Pippenger, John J.
Back Pressure . . . How it Affects Valve Operation Oct. p 85

Roberts, Gene
How to Select a Fixed Displacement Pump and Motor Drive Nov. p 68

Rolnick, Paul
Fluid Power Circuits Jan. p 33

Romine, Paul and Andrew Armstrong
Hydraulic Drill Feed Design June p 65

Sacchini, C. R.
Design of a Hydraulically Operated Aircraft Windshield Wiper Feb. p 53

Sadler, C. L.
Hydraulic Transmission for Aircraft Accessory Drives Feb. p 56

Samuel, H. D. and J. L. Dooley
Moisture and Pressure Control in a High Pressure Pneumatic Circuit May p 100

Sant, John
Sequence Control on Multiple Spot Welders June p 63

Schmidlin, A. E.
Potential Advantages of the 5000 Psi Pneumatic System Oct. p 118

Schubert, Karl
Controlled Spindle Positioning Attachment Oct. p 76

Shaltz, Frederick J.
Design of a Reciprocating Oil Intensifier Nov. p 55

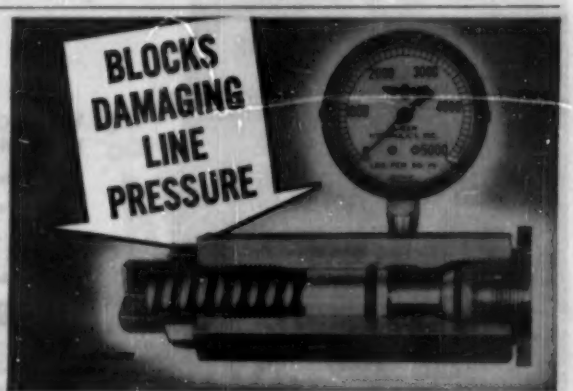
"MONOBALL"
Self-Aligning Bearings

CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (600-1200 degrees F.).
2	Chrome Molly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Molly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Address Dept. AH-54

SOUTHWEST PRODUCTS CO.
1705 So. Mountain Ave. • Duarte, California
(LOS ANGELES COUNTY)



New Improved Greer Cutout Valve Protects Your Expensive Gauges Meters and Instruments

Now get low-cost, positive protection that never needs watching. The new improved Greer Cutout Valve automatically blocks line pressures that exceed the operating range of the gauge insuring against damage or breakage. The valve reopens only when the pressure drops to the normal range of the gauge. This eliminates manual operation of shut-off valves saving you costly man-hours.

Available in pressure ranges from 10 psi to 5,000 psi. Interchangeable springs convert valve from one pressure range to another easily. Greer Cutout Valves pay for themselves quickly. For low-cost protection, call Greer today.

GREER HYDRAULICS INC.
International Airport • Jamaica 30, N. Y.

Fill in No. 88 on Reader Service Card

Fill in No. 109 on Reader Service Card

Smith, Edward
Controlled Feeds and Speeds Give Constant Chip Load Oct. p 127

Smith, J. H. and H. W. Brown
Hydraulic and Electric Circuitry for Machine Tools Dec. p 44

Soman, Robert
Floating Cushion Protects Dies from Overload Apr. p 92

Spicer, C. and T. Baxter
Air Power Clamps then Ejects Small Parts Apr. p 84

Spurr, Robert
Low Pressure Bleeding of Hydraulic Systems Dec. p 52

Stampfl, Walter and Lee Drasin
How to Prevent Hydraulic Shock on Mobile Equipment Oct. p 72

Steel, A. M. and C. B. Blake
Accumulator Circuit Reduces Operating Temperature and Gives Constant Cycle Time June p 60

Steel, A. M. and C. B. Blake
Pump Control System for Large Press Installation Mar. p 74

Steel, A. M. and C. B. Blake
Mounting a Trunnion Cylinder in Limited Space Apr. p 82

Steinmetz, Joseph N. Jr.
Brake Design for Jet Aircraft Gives Split-Second Response June p 86

Steinmetz, Joseph N. Jr.
"Power in A Smaller Package"—Evaluating 5000 Psi Hydraulic Systems Nov. p 80

Stevens, J. B. and Harold F. Griener
Mechanical Seals for Hydraulic Equipment June p 70

Stewart, H. L.
Is Your Hydraulic Tooling Safe? Apr. p 68

Tankard, James
Differential Circuits Sept. p 63

Tarasewich, Michael
Swivel Fittings for Aircraft Hydraulic Systems July p 86

Tyler, Ransom
Hydraulic Drives for Continuous Process Industries July p 64

Vokac, C. W.
Two Pump Metering Circuit Solves Costly Control Problem Dec. p 33

Williams, Norton
An Electro-Hydraulic Servo Pump Mar. p 63

Witmer, Emmett A., Walter Hermann, and Vaughn L. Beals, Jr.
Shock Tests Made Safer with Electrically Controlled Circuit Nov. p 72

Woodling, George V.
Patents, Trademarks and Copyrights Sept. p 72

Wright, Fred D. and Lewis H. Brakel
Controlled Speed, Thrust and Torque Aug. p 44

Zagar, Frank
Fluid Motor Drive for Rotary Cutting Tools Apr. p 79

Zagar, Frank
Mechanical Design for Transfer Devices July p 58

Zimmerman, Louis
Simplified Valving Feb. p 37

Enter Now

1955 APPLIED HYDRAULICS MAGAZINE

Prize Paper Contest

$1200 IN CASH AWARDS

You can win one of the cash awards being offered in the 3rd annual APPLIED HYDRAULICS Magazine Prize Paper Contest. Anyone who uses, designs, builds or maintains pneumatic or hydraulic machines or equipment can enter this contest.

HERE'S WHAT YOU CAN WIN:

1st PRIZE	2nd PRIZE	3rd PRIZE	4th through 7th
$500	$300	$200	Prizes $50

. . . and all other papers judged as meriting publication will be paid for and published in APPLIED HYDRAULICS.

WHAT KIND OF ARTICLE?

Your copies of APPLIED HYDRAULICS are the best guide for the type of article and presentation. To learn what the judges in 1953 and 1954 considered as prize winners, take a look at the October 1953 and October 1954 issues.

HOW DO YOU ENTER?

Write to the APPLIED HYDRAULICS Prize Paper Contest Editor for an entry blank. We'll send you a blank and suggestions to help prepare your article. To win a cash award, your article must be mailed by June 1st, 1955.

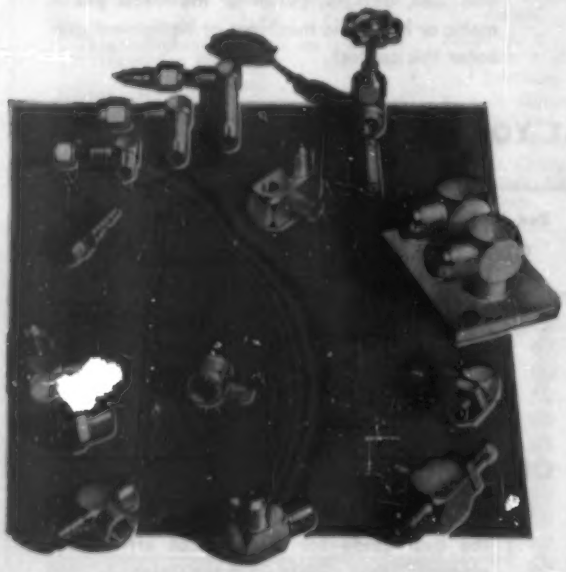
Write today for your entry blank—APPLIED HYDRAULICS, 1240 Ontario, Cleveland 13, Ohio

Fill in No. 108 on Reader Service Card

Connect up with L and L

The Complete Line of Steel Fluid Power Couplings

JIC Flare Tube — Pipe Threaded
Flare Tube — Straight Thread "O" Ring
Flange Mounted — "O" Ring Seal



A—JIC Flare Tube Fittings
B—Manifold Fitting
C—Needle Valve
D—Pipe Nipple
E—Flange Manifold
F—Straight Thread, "O" Ring Seal Fitting
G—Ball Check Valve
H—Lateral Outlet Fitting
I—Universal Elbow
J—Dryseal Pipe Fitting
K—Hex Reducing Bushing
L—Swivel Elbow
M—Barbed Hose Stem

You can depend on L & L's quality, availability, and selection of steel couplings for piping all industrial hydraulic circuits.

Distributors in principal cities
Write for catalog No. 53

L and L MANUFACTURING COMPANY
8088 E. Nine Mile Rd., Van Dyke, Mich.

Fill in No. 108 on Reader Service Card

HIGH PRESSURE PUMP

air driven
FOR PRESSURES TO 30,000 PSI

Measures 8¼" wide x 9¾" deep

Boost 100 PSI. air pressure to 10,000 PSI. fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models for output fluid pressures of 1,000 to 30,000 PSI. Special models for lower or higher pressures.

Applicable wherever low volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.

SPRAGUE
Engineering Corporation
1144 WEST 135TH STREET, GARDENA, CALIFORNIA

Specify AIRMATIC QUALITY FOR:

1. FLOW CONTROL VALVES
2. SEQUENCE VALVES
3. PRESSURE REGULATORS
4. CYLINDERS
5. SOLENOID VALVES

Write for Complete Details about AIRMATIC Products

Attractive O.E.M. and Quantity Discounts
Delivery from Stock —Immediate

AIRMATIC VALVE, INC.
7317 Associate Ave. • Cleveland 9, Ohio

Fill in No. 54 on Reader Service Card

Fill in No. 4 on Reader Service Card

Advertisers' Index

December 1954

A

Ace Products Co. 87
Adel Division of General Metals Corp. 61
Air-Mite Industrial Air Equipment, Inc. 110
Airmatic Valve Company 118
Almo Tool Co. 84
American Crucible Products Co. 62
American Engineering Co. 23
American Hollow Boring Co. 119
Anchor Coupling Co., Inc. 17
Anker-Holth Div. of Wellman Engineering Co. 4
Atsco 120
Auto-Diesel Piston Ring Co. 66
Automatic Valve Co. 85

B

Barksdale Valves 83
The Bellows Co. 75
Benton Harbor Engineering Works 62
Brown & Sharpe Mfg. Co. 82
W. R. Brown Corp. 112

C

Capital Engineering & Mfg. Corp. 66
Carbide & Carbon Chemicals Co. Div. of Union Carbide & Carbon Co. 27
Cardwell Machine Co. 70, 102
Century Hydraulics, Inc. 111
Celanese Corp. of American Chemical Division 91
Cleco Division of Reed Roller Bit Co. 8
Commercial Shearing & Stamping Co. 49

D

Darling Valve & Mfg. Co. 28
The Denison Engineering Co. 67
Dowty Hydraulic Units, Ltd. 25
Dudco Division New York Air Brake Co. 29

E

Eastman Mfg. Co. 11
Electro-Snap Switch & Mfg. Co. 87

F

Flex-O-Tube Div. Meriden Corp. 74
Fluid Controls, Inc. 96

G

Gadgets, Inc. 120
Galland-Henning Nopak Division 92
Gast Mfg. Corp. 86
Greene, Tweed Co. 88
Greer Hydraulics, Inc. 68, 116
Gresen Manufacturing Co. 112

H

Hanna Engineering Works 1
Hannifin Corp. 101
Hansen Mfg. Co. ..... Cover 2
Harrison Radiator Division General Motors Corporation 59
E. F. Houghton & Co. 71
Howell Electric Motors Co. 5
Hydraulic Association of Great Britain 70
Hydraulic Unit Specialties Co. 96

J

James-Pond-Clark 110
Johns-Manville Corp. 65
Joy Manufacturing Co. 20

K

Keelavite Rotary Pumps & Motors, Ltd. 51
Kraissl Co., Inc. 81

L

L & L Manufacturing Co. 118
Lenz Co. 94
Lindberg Engineering Co. 86
Linear, Inc. 63
Logan Engineering Co. 114
Loud Machine Works, Inc. 57
Lucas-Milhaupt Engineering Co. 94

NOW!

PRODUCE

A.N.D. 10050

PORT CONTOURS

3 TIMES FASTER!

The new Sonnet Port Contour Cutter completes all five operations in one pass!

Chamfering, counterboring, radiusing, countersinking, spot facing... all five are necessary to produce the A.N.D. 10050 port contour or connecting hole. Now, with Sonnet's new four-fluted, special-purpose contour cutter, all five operations can be completed with a single pass, *reducing job time as much as two-thirds!*

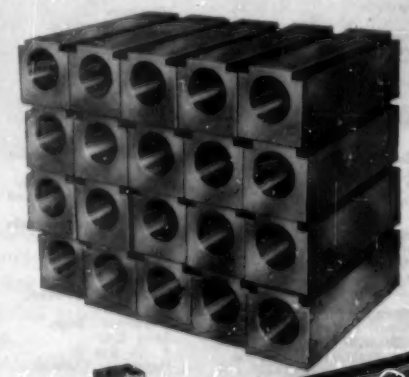
The new cutter is made from alloy steel and hardened for toughness. Carbide tips on all four flutes assure longer cutting life and smoother finish. Available in all sizes with integral or replaceable pilots.

Write for descriptive literature and prices today

Sonnet TOOL AND MFG. CO.

376 No. Prairie Avenue, Hawthorne, California

Specialists in carbide and high speed steel cutting tools



Hydraulic CYLINDERS to specification

AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to

AMERICAN HOLLOW BORING COMPANY

1954 Raspberry St., Erie, Pa.

HOW HYDRO-WYPES

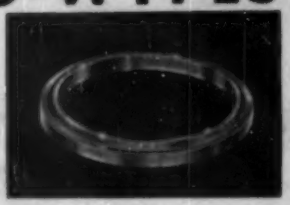
(Trade Mark Reg.)

take the

AGGRAVATION

out of

AUTOMATION



(AN 6231-A)

PROBLEM # 5 —

A manufacturer of shell molding equipment was experiencing difficulty with high temperature, resin impregnated sand sticking to guide bars and hydraulic cylinder shafts. On hydraulic cylinders the sand and resin would score the shafts and cut the packings, while on the guide bars, difficulty was experienced in galding and scoring and eventual binding of the operating equipment.

SOLUTION —

Hydro-Wipe "A" Scraper Rings were installed in seven places on this equipment.

RESULTS —

The resin and sand were removed from the guide bars and cylinder shafts; "down time" and maintenance costs were reduced to a bare minimum.

Do you have problems in your foundry with your molding equipment, sand rammers, vibrators? If so, contact your nearest Hydro-Wype Scraper Ring Representative or write to ATSCO for the solution to your problems.

LOOK FOR THIS DECAL ON EQUIPMENT YOU BUY

EQUIPPED FOR LONGER LIFE with HYDRO WYPE SCRAPER RINGS

YOU CAN TELL THE QUALITY OF A PRODUCT BY THE COMPANY IT KEEPS

For an immediate solution to your problems, contact your nearest representative . . .

New York, Connecticut, Massachusetts, Rhode Island
Nielsen Hydraulic Equipment, Inc
4 Penn Place
Pelham Manor 65, New York

Eastern Pennsylvania, Delaware
J. Neill Armstrong
426 Addison Avenue
Westmont, New Jersey

Colorado, New Mexico, Utah, Wyoming, Idaho, Alaska
Fred A. Pease
P. O. Box 1566 Stapleton Airfield
Denver, Colorado

Kansas
Claude Mann & Associates
237 South Hydraulic Street
Wichita 7, Kansas

Eastern Wisconsin
Mechell Rubber & Supply Co.
1730 North 12th Street
Milwaukee 5, Wisconsin

Northern California
Haskel Engineering & Supply Co.
1245 22nd Street
San Francisco 7, California

Minnesota, Montana, South Dakota, North Dakota, Western Wisconsin
W. F. Aske & Son
5407 Excelsior Blvd.
Minneapolis, Minnesota

Arizona
Wheel Industries
2600 South Santa Fe Avenue
Los Angeles 58, California

Southern California
Haskel Seals
1236 South Central Avenue
Glendale 4, California

Southern Ohio, Kentucky
J. A. Lombard Co.
P. O. Box 481
Dayton 2, Ohio

Western New York
H. D. McRae
70 Queens Street
Rochester 9, New York

Nevada, Hawaii
Wheel Industries
2700 16th Street
San Francisco, California

Indiana
Wellman Engineering Co.
4618 Winthrop Avenue
Indianapolis 5, Indiana

Dallas
Stance Co.
1914 Canton St.
Dallas, Texas

Bill Coleman Assoc.
P. O. Box 6028
Dallas 1, Texas

Michigan
F. B. Wright Co.
1565 Oakman Blvd.
Detroit 6, Michigan

Northern Ohio
Elmer W. Pfeil, Inc.
624 Engineers Blvd.
Cleveland 14, Ohio

Maryland, Virginia
Howell-Lanier Co.
4703 Ritchie Highway
Baltimore 25, Maryland

Western Pennsylvania
Elmer W. Pfeil, Inc.
610 Smithfield St.
Pittsburgh 2, Pa.

Ontario & Quebec, Canada
Higginson Engr. Sales Co.
P. O. Box 23
Hamilton, Ontario, Canada

Oklahoma, Nebraska, Western Iowa & Western Missouri
Ellis Akin Engineering Co.
3429 Broadway
Kansas City, Missouri

Illinois, Eastern Iowa
Agair Equipment Co., Inc.
3454 West Lake St.
Chicago 24, Ill.

. . . or write to

atsco

1926 East Siebenthaler Ave.
Dayton 4, Ohio

Nation wide sales & service representatives for

Gadgets, inc.

★ Hydro-Wypes available 5/16" to 30" Dia.
★ Hydro-Wype Adapters available for quick, easy installation on existing equipment.
★ Approved Specification MIL-S-5049.

Advertisers' Index

M

Marvel Engineering Co. 19
Miller Fluid Power Co. 31
Minnesota Rubber & Gasket Co. 2
Modernair Corp. 56
Monsanto Chemical Co. 109
Mullins Mfg. Corp. Koldflo Division .. 69

N

New York Air Brake Co. 29
W. H. Nicholson & Co. 114

O

Ortman-Miller Machine Co. 90

P

Pacific Division Bendix Aviation Corp. 53
Palley Supply Co. 85
Pantex Mfg. Corp. 95
Parker Appliance Co. 9
Pathon Mfg. Co. 103
Pesco Products Div. Borg-Warner Corp. ..... Cover 3
Plastic & Rubber Products Co. 22
Precision Rubber Products Corp. 7

R

Racine Hydraulics & Machinery, Inc. ..115
Republic Mfg. Co. 98
J. E. Rhoads & Sons 97
Rivett Lathe & Grinder, Inc. 89
George D. Roper Corp. 64

S

Sealol Corporation 16
W. S. Shamban & Co. 111
Simplex Engineering Co. 58
Skinner Electric Valve Div. Skinner Chuck Co. 21
Snap-Tite, Inc. 93
Sonnet Tool & Mfg. Co. 119
Southwest Products Co. 116
Sparta Mfg. Co. 84
Sprague Engineering & Sales Corp. 26, 118
Standard Oil Co. (Indiana) 79
Standard Pressed Steel Co. 83
Star Jack Company, Inc. 83
Summerill Tubing Co. Div. of Columbia Steel & Shafting Co. 111
Sun Oil Company 24
Superior Tube Co. 60

T

The Texas Co. 32
Towler Bros. (Patents) Ltd. E'ectraulic Works 30

U

U. S. Electrical Motor, Inc. 80
U. S. Gasket Co. 113
U. S. Hoffman Machinery Corp. 107

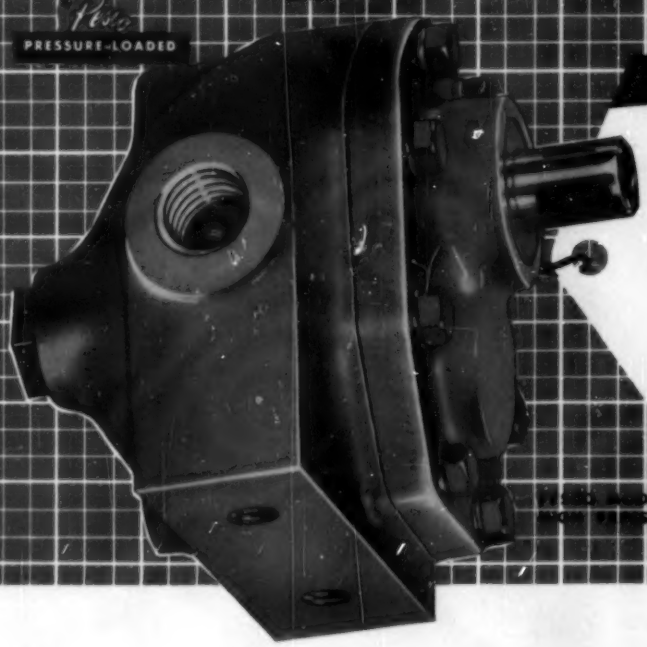
V

Valvair Corp. 15
Vickers, Inc. 77
Vickers-Armstrongs, Ltd. 13

W

Waterman Engineering Co. 12
Westinghouse Air Brake Co. 106
S. S. White Dental Mfg. Co. Plastic Div. 104

HERE'S A REALLY GREAT HYDRAULIC PUMP... it's PROVED and AVAILABLE!



DEPENDABLE OPERATION • LOW MAINTENANCE

Pesco

HIGH PRESSURE GEAR PUMP

PRESSURES UP TO 2000 PSI

EFFICIENCIES: VOLUMETRIC—UP TO 94%
MECHANICAL—UP TO 88%

OPERATION: CONTINUOUS DUTY WITH OIL AT 150° F.

CAPACITY: 11 GPM AT 2400 RPM

AUTOMATIC ADJUSTMENT FOR OPERATING WEAR

Here is a new Pesco *Pressure-Loaded* Pump you will want to investigate immediately! It is one of the most outstanding of many fine Pesco pump products, and provides unparalleled advantages for hydraulic power applications.

New developments of the famous Pesco Pressure-Loaded principle incorporated in this model have resulted in new high standards of performance and dependability. From the original development tests through many rugged field applications, this Pesco pump has constantly exceeded anticipated performance.

With volumetric efficiencies up to 94%, mechanical efficiencies up to 88%, and capacity of 11 gpm, it develops pressures up to 2000 psi. In addition, it operates on continuous duty with oil temperature of 150° F.

Pesco Hydraulic Engineers will be glad to show you how this outstanding Model 051002-110 will improve operation of your equipment. Simply call or write the Home Office, Bedford, Ohio.

Call or write the Home Office, Bedford, Ohio for full information on Hydraulic Pumps, Power Packages, Hydraulic Motors, Electric Motors, Controls and Valves.

engineering **Pesco** production

PRODUCTS DIVISION

AGRICULTURAL · INDUSTRIAL · AIRCRAFT · AUTOMOTIVE · CONSTRUCTION · EARTH MOVING

PRODUCING THE BEST IN HYDRAULIC EQUIPMENT AND ELECTRIC MOTORS

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD • BEDFORD, OHIO

Fill in No. 75 on Reader Service Card

As You Sit Down To Make Advertising Decisions For 1955 . . .

We have some helpful Tools for You

As you sit down to make advertising decisions for 1955 you face the responsibility for spending a good many dollars to make sales programming work in the fields you want to sell. Here is some important new information about Applied Hydraulics Magazine that we believe you will find most helpful.

NEW! The second ACTION AUDIT, our continuing study of WHO reads business paper advertising, WHAT they read, HOW they read it . . . and WHAT they do about it, has just been completed for our magazine. There's a wealth of useful data in a form that can be applied directly to your product, your market, your sales problem. We would be happy to go over it with you.

NEW! A new NIAA report for our publication is fresh from the press. Without sales promotion material of any kind, factual complete reference data is available for your quick information, exactly as asked for by the National Industrial Advertisers Association. We'll be glad to send you a copy upon request.

NEW!

What is Franchise Circulation?

Franchise Circulation is the method devised by Industrial Publishing more than twenty years ago, to reach those individuals, regardless of title, who control specification or purchase in the markets served by its magazines.

How is Franchise Circulation Secured?

Wholesale distributors in the field served by the magazine, subscribe to the magazine for the men their salesmen designate as the active sales decision-makers. They are the men your salesmen have to convince to make a sale.

How is Franchise Circulation Kept Current?

The distributor pays fifteen cents a month for each copy we mail for him, and changes in his list are made monthly. The changes are made by his own sales staff, who are alert to see that the magazine continues to reach those people who can buy from them.

How does Franchise Circulation Help Your Sales?

The distributor salesman who named the man who gets the magazine did so because he has to sell him. So do you and your competitor. When he picks up the magazine of his industry, to read about its products and its processes he has the leisure and the interest to be paying attention to the very problem that you can help him solve. That's the showcase for your advertising story . . . before The Right Man, in The Right Place, at The Right Time.

How does Franchise Circulation Help Your Salesman?

When your advertisement has reached The Right Man.

(a) It can lead to an inquiry, which will give your salesman an active lead, since it came from the man with the power to buy.

(b) It can develop an interest in The Right Mind, making later entree for your salesman easier.

(c) It can repeat your salesman's story many times after his call, keeping alive the investment he has made in calling.

APPLIED HYDRAULICS MAGAZINE

1249 ONTARIO STREET • CLEVELAND 13, OHIO